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Della Beffa (G.). **Gli insetti dannosi all'agricoltura ed i moderni metodi e mezzi di lotta.** [Insects harmful to agriculture and modern methods and means of control.]—3rd edn., xx+1106 pp., 16 col. pls., 1506 figs. Milan, U. Hoepli, 1961. Price *L.* 10500.

This third edition of a well-known text-book on the insect and other invertebrate pests of cultivated plants, forest trees and stored products in Italy and their control [*cf. R.A.E.*, A **37** 446, etc.] has been considerably revised and extended, again largely as a result of the author's own investigations. The number of pests dealt with has been increased, and some that seem likely to spread to Italy from neighbouring countries are now included. The section on chemical control has been expanded by the inclusion of information on recent synthetic insecticides and acaricides, notably those having systemic action.

Hyde (G. E.). **Teach yourself entomology.**—*Teach Yourself Books*, 7×4¼ in., xxi+158 pp., col. frontis., 8 pls., 8 figs. London, Engl. Univ. Pr. Ltd., 1961. Price 7*s.* 6*d.*

This book is intended as an introduction to entomology and consists of a general discussion of the nature, morphology and life-history of insects, followed by chapters on the different orders, with information on selected species, and one on the collection and preservation of insects. The emphasis is on species that occur in Britain, and popular names are used almost exclusively.

Hughes (A. M.). **The mites of stored food.**—*Tech. Bull. Minist. Agric.* no. 9, 9½×6 in., [1+] vi+287 pp., 385 figs., 5½ pp. refs. London, H.M.S.O., 1961. Price 17*s.* 6*d.*

This is a revised and greatly expanded version of the author's earlier work [*R.A.E.*, A **37** 7] and resembles it in scope, the mites concerned being mainly those that are pests of stored food products or predacious on such pests, and the emphasis is on conditions in Britain and Northern Ireland, though most of the species also occur in other countries or are cosmopolitan in distribution. The classification and nomenclature of the mites have been completely revised, the number of species is increased, and more space is devoted to descriptions and accounts of bionomics. The keys and figures remain an important feature of the work.

Green (A. A.) & Kane (J.). **Practical control of the warehouse moth *Ephestia elutella* (Hb.) using pyrethrum spray.**—*Pest Technol.* **2** no. 4 pp. 61–64, 2 figs., 9 refs. London, 1960.

The following is virtually the authors' summary. A large-scale trial is described in which bagged cacao stored in a warehouse in Britain heavily infested by *Ephestia elutella* (Hb.) was completely protected from infestation by the application of an insecticide containing 0·3 per cent. pyrethrins and 3 per cent. piperonyl butoxide to the outside of the stacks. The spray was applied monthly at the rate of 1 gal. per 5,000 sq. ft. The estimated costs of labour and insecticide for the protection of 5,000 bags of cacao, valued

at approximately £100,000, was about £30 for the 5-month period of moth activity.

PENCE (R. J.). **A new approach to fabric pest control. Novel method starves fabric pests by incorporating antimetabolites in diet.**—*Soap & chem. Spec.* **35** no. 8 pp. 65–68, 105–106, 7 figs., 14 refs. New York, N.Y., 1959.

Although clothes moths (*Tineola bisselliella* (Humm.)) and Dermestids feed mainly on textiles, cleaned natural fibres do not contain enough nutriment to allow them to complete their development normally. It has been shown that factors of the vitamin-B complex are necessary for successful development of *T. bisselliella*, and that little or no growth takes place in the absence of niacin (nicotinic acid) or pantothenic acid. Supposedly clean fabrics that are attacked must have been contaminated with essential supplementary nutrients, either directly, when food or liquids have been spilled on them, or indirectly as a result of synthesis by micro-organisms, which results in the production of essential vitamins in small but important amounts; large quantities of pantothenic acid become available through direct or indirect contamination. Preliminary investigations on the possibility of depriving the insects of their dietary needs by the use of antimetabolites, which bear a chemical similarity to vitamins or other metabolites and function as biological antagonists to them, are described in this paper. The specific value of each compound must be determined by identifying the metabolite and finding which analogue is antagonistic to it. It was found that sulphanilamide in a fabric inhibited the synthesis of niacin and pantothenic acid by micro-organisms and, to some extent, antagonised niacin present as a result of direct contamination, and treatment with an aqueous solution of sulphanilamide and picolinic acid protected a fabric sample from attack by *Anthrenus flavipes* Lec. (*vorax* Waterh.). Observations showed that antimetabolites produced signs of abnormality in the insects and, in preliminary tests, produced a break in the metabolic chain and so caused larvae of *T. bisselliella* to perish from starvation. Possible methods of impregnating fabrics with the compounds, to give permanent protection, are described, and encouraging results are reported from the treatment of hair fibres.

KURIR (A.). **Dunkler Zierbock (*Anaglyptus mysticus* L.), ein technischer Zerstörer des Erlenholzes.** [*A. mysticus* technically injurious to alder wood.]—*Holzforsch. u. Holzverwert.* **11** pt. 1 pp. 7–11, 2 figs., 89 refs. Vienna, 1959. (With a summary in English.) **Dunkler Zierbock (*Anaglyptus mysticus*), ein Zerstörer des Laubholzes.** [*A. mysticus* injurious to wood from deciduous trees.]—*Allg. Holzrdsch.* **15** Juliheft repr. [2] pp., 2 figs. Vienna, 1959.

In these two papers, the author records that adults of *Anaglyptus mysticus* (L.) emerged in a factory near Vienna in September 1958 from pattern blocks made of alder wood six years previously. There were few signs of infestation, which must have begun before the blocks were made. The nomenclature, geographical distribution, occurrence in Austria, food preferences and habits of the Cerambycid are reviewed from the literature in .the first paper, and its appearance and bionomics in the second. Fumigation with carbon bisulphide controlled the larvae and pupae remaining in the wood.

Bollow (H.). **Die landwirtschaftlich wichtigen Erdraupen (Gattung *Agrotis*). Auftreten, Aussehen, Lebensweise und Bekämpfung.** [Agriculturally important cutworms (genus *Agrotis*). Occurrence, appearance, mode of life and control.]—*Prakt. Bl. PflBau* **55** no. 3 pp. 86–101, 9 figs. Munich, 1960.

In view of serious damage to crops by cutworms, mainly species of *Agrotis*, in Bavaria in 1958–59, the author describes the life-history of these Noctuids, gives keys to the adults and larvae and summarises the principal characters and bionomics of the main species and reviews methods of forecasting and controlling infestation.

Wagner (F.). **Über Untersuchungen zur Ursache und Bekämpfung der totalen Weissährigkeit an Gräsern.** [On investigations on the cause and control of complete white-ear of grasses.]—*Prakt. Bl. PflBau* **55** no. 5–6 pp. 137–147, 9 figs., 16 refs. Munich, 1960.

The following is based on the author's summary. A white-ear condition involving whole ears of pasture grasses grown for seed in part of Bavaria was investigated in 1957–60 and found to result from infestation by *Miris* (*Leptoterna*) *dolabratus* (L.). From preliminary tests of sprays against this Mirid, three applications of endrin between the end of April and mid-June are recommended. The insect overwinters in the egg stage on the grass remains, and low cutting and thorough cultivation or ploughing of the soil in autumn reduce the population.

Fritzsche (R.). **Der Schattenwickler (*Cnephasia wahlbomiana* L.) als Schädling an Lein und Hanf.** [*C. virgaureana* as a pest of flax and hemp.]—*Wiss. Z. Univ. Halle* (Math.-Nat.) **8** pt. 6 pp. 1117–1119, 3 figs., 8 refs. Halle, 1959.

Cnephasia virgaureana (Treitschke) (*wahlbomiana*, auct.), of which the food-plants in Germany are reviewed from the literature, was recorded for the first time on flax and hemp (*Cannabis sativa*) in the Halle-Magdeburg region in 1958–59. Larvae were observed on flax from mid-April and were most numerous in the first half of May. They rolled and webbed together the tips of the shoots and fed mainly on the younger leaves and on buds. On hemp, larvae were observed from mid-May and fed, in addition, on the lower leaves, but the shoot-tips were not completely destroyed. Pupae were found in the webs on both plants and also at the bottom of the stems.

Koch (H. A.). **Gelbschalen als Lockfallen für die Fritfliege (*Oscinis frit* L.).** [Yellow dishes as traps for the frit fly, *Oscinella frit*.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **14** pt. 1 p. 15, 1 graph. Berlin, 1960.

Investigations in Germany showed that yellow trap-dishes of the type used by Moericke against aphids [*cf. R.A.E.*, A **35** 359], filled with water and a little wetting agent, are effective traps for the adults of *Oscinella* (*Oscinis*) *frit* (L.) [*cf.* also **49** 142].

Lembcke (G.). **Über ein starkes Auftreten des Rübenderbrüsslers** (*Bothynoderes punctiventris* **Germ.) in Schöneiche bei Zossen** (**Brandenburg**). [An outbreak of the beet weevil, *Cleonus punctiventris*, in Schöneiche bei Zossen (Brandenburg).]—*NachrBl. dtsch. PflSchDienst* (N.F.) **14** pt. 1 pp. 16–17, 13 refs. Berlin, 1960.

Cleonus (*Bothynoderes*) *punctiventris* (Germ.), which was hitherto unknown in Brandenburg, became numerous on beet in one locality in 1959. Infestation began in early May and reached its peak in early June.

Müller (F. P.). **Die Apfelgraslaus** *Rhopalosiphum insertum* (**Walk.**)**—ein bisher mit der Grünen Apfellaus** *Aphis pomi* **De Geer verwechselter Schädling.** [The apple-grass aphid, *R. insertum*—a pest hitherto confused with *A. pomi*.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **14** pt. 4 pp. 74–79, 3 figs., 24 refs. Berlin, 1960. (With summaries in Russian & English.)

The following is based on the author's summary. In the spring of 1959, many apple orchards in the district of Rostock, eastern Germany, were heavily infested by the oat-apple aphid, *Rhopalosiphum insertum* (Wlk.) [*cf. R.A.E.*, A **47** 353], which has not been recorded as a pest of apple in central Europe. In northern and central Germany, it is common on hawthorn (*Crataegus oxyacantha*) and sometimes on related plants, and has apparently been misidentified on apple as *Aphis pomi* Deg.

Fröhlich (G.). **Untersuchungen zur Biologie und Bekämpfung der Fuchsschwanzgallmücken** *Dasyneura alopecuri* **Reuter und** *Contarinia merceri* **Barnes.** [Investigations on the biology and control of the meadow-foxtail gall-midges, *D. alopecuri* and *C. merceri*.]—*NachrBl. dtsch. PflSchDienst* (N.F.) **14** pt. 5 pp. 81–86, 2 figs., 6 refs. Berlin, 1960. (With summaries in Russian & English.)

The following is based on the author's summary. The author describes the bionomics and distribution of *Dasyneura alopecuri* (Reut.) and *Contarinia merceri* Barnes on meadow foxtail (*Alopecurus pratensis*) in central Germany and shows that infestation by these Cecidomyiids is likely to increase with the increasing cultivation of this grass. In tests on control, several proprietary insecticides gave good results, including sprays of methyl-parathion (Wofatox) or a mixture of DDT and BHC (Spritzgesaktiv).

Mémoires originaux sur la lutte biologique contre les insectes forestiers au moyen des fourmis du groupe *Formica rufa* **L.**—*Entomophaga* **5** no. 1 pp. 9–86, figs., refs. Paris, 1960.

The papers published under this heading consist of an introduction in English by M. Pavan (pp. 9–11), who briefly reviews the importance of ants of the group of *Formica rufa* L. in the control of forest pests in western Europe, the necessity for further research on them, and the initiation of co-operative investigations in various countries under the guidance of the International Commission for Biological Control, and six scientific contributions, which are noticed below.

Gösswald (K.) & Schmidt (G.). **Neue Wege zur Unterscheidung der**

Waldameisenformen (Hymenoptera, Formicidae) [New ways of differentiating the forms of forest ants], pp. 13–31, 6 figs., 58 refs., with summaries in French & Italian. The morphological differentiation of ants of the group of *F. rufa* has presented considerable difficulties. Early attempts were based on the system of Forel, and the senior author distinguished three subspecies, with subordinate forms of one of them [*R.A.E.*, A **35** 212]. Other authors adopt other names, however, and a table is given in which the various systems are compared. This shows that the *F. lugubris* Zett., 1850, of Gösswald is referred to as *F. rufa* L., 1758 [rejected by the International Commission in 1956 in favour of *F. rufa* L., 1761] by Bondroit, *F. rufa* L., 1768, by Betrem and *F. lugubris* Zett., 1840, by Yarrow, that his *F. rufa pratensis* Retz. is referred to as *F. pratensis*, *F. congerens* Nyl. and *F. nigricans* Emery by the other three authors, respectively, and his *F. rufa rufa* L., 1761, as *F. piniphila* Schenkl., *F. maior* Nyl. and *F. rufa*, 1761, respectively. Gösswald's *F. rufa rufopratensis* Forel form *minor* is referred to as *F. polyctena* Först. by Bondroit and Betrem but does not fit into Yarrow's system, and his *F. rufa rufopratensis* form *major* is not accommodated in the systems of any of the other three authors. The characters differentiating Gösswald's four forms of *F. rufa* are illustrated and discussed, as are also their differing habits. Work has recently been begun on biochemical differentiation by means of paper chromatography; 29 fluorescing materials have been distinguished in workers of these ants, and their distribution in the different forms has been studied. The results so far obtained, which are discussed, largely support the morphological and biological data, and confirm the separation of *F. rufa rufopratensis* form *major* from the very similar *F. rufa rufa*, but indicate similarities between some types of *F. rufa rufopratensis* form *minor* and *F. rufa pratensis* and the existence of still further forms within these last two [*cf.* **40** 281]. A final revision of the group must await further investigations.

Gösswald (K.) & Kloft (W.). **Untersuchungen mit radioaktiven Isotopen an Waldameisen** [Investigations with radioactive isotopes on forest ants], pp. 33–41, 1 graph, 14 refs., with summaries in French & Italian. Radioactive phosphorus (^{32}P) was used to study the distribution of proventricular food among the members of colonies of ants of the group of *F. rufa*, and the results are recorded and discussed.

Kloft (W.). **Die Trophobiose zwischen Waldameisen und Pflanzenläusen mit Untersuchungen über die Wechselwirkungen zwischen Pflanzenläusen und Pflanzengeweben** [Trophobiosis between forest ants and aphids, with investigations on the mutual relations between aphids and plant tissues], pp. 43–54, 1 fig., 30 refs., with summaries in French & Italian. Ants of the group of *F. rufa* feed on the honeydew of aphids that occur on forest trees [*cf.* **48** 441], provided that they are not covered with waxy secretions. Since most of the aphids present are so covered, they are not favoured by ants. Furthermore, only species that feed in the phloem produce sufficient honeydew to be much visited.

Müller (H.). **Der Honigtau als Nahrung der hügelbauenden Waldameisen** [Honeydew as food for mound-building forest ants], pp. 55–75, 8 figs., 40 refs., with a summary in Italian. The author reviews the importance of honeydew as food for ants of the group of *F. rufa*, and shows from observations in Germany that in mixed forests of conifers and deciduous trees, or conifers only, the ants visit different aphids on various trees at different times during the season. A mixed forest therefore offers the most favourable conditions for them. The ants foster the aphids, but the resulting losses can be offset by making use of the honeydew to obtain greater honey production by bees.

Bruns (H.). **Über die Beziehungen zwischen Waldvögeln und Waldameisen** [The relations between forest birds and forest ants], pp. 77–80, 7 refs., with a summary in Italian. Observations in Germany showed that predacious birds were more numerous in forest areas in which ants of the group of *F. rufa* were present; the cause was unknown.

Lange (R.). **Die systematischen Grundlagen der Waldameisenvermehrung in Deutschland** [The systematic basis of forest-ant rearing in Germany], pp. 81–86, 1 graph, 13 refs., with summaries in French & Italian. The author states that two forms have commonly been confused in colonising forest ants of the group of *F. rufa* in Germany, referred to as *F. rufa* and *F. polyctena* by authors other than Gösswald [*cf.* above]. They are, however, mutually antagonistic. Characters by which the workers and the colonies can be differentiated are described, and it is proposed that only the second form should be used henceforth.

Brnetić (D.) & Petrić (J.). **Ispitvanje utjecaja ekofaktora na preobrazbu maslinove muhe 1954–1955 godine.** [A study of the influence of ecological factors on the metamorphosis of *Dacus oleae* in 1954–55.]—*Plant Prot.* no. 45 pp. 49–56, 12 refs. Belgrade, 1958. (With a summary in English.)

In experiments at Split, Yugoslavia, in 1954–55 with larvae and pupae of *Dacus oleae* (Gmel.), it was found that neither the variety nor the degree of ripeness of the olives had any effect on the time of pupation or the duration of the pupal stage, temperature being the main factor. The pupae ceased development during short periods of low temperature, and long periods resulted in complete mortality. No diapause was observed, and the threshold of development was about 10°C. [50°F.].

Nikolić (D.). **Klimatske prilike i pojava jabučnog smotavca u Tetovu u toku petogodišnjeg perioda (1952–1956).** [Climatic conditions and the appearance of *Cydia pomonella* in Tetovo in the five-year period 1952–56.] *Plant Prot.* no. 45 pp. 67–74, 5 graphs, 5 refs. Belgrade, 1958. (With a summary in French.)

Observations in central Yugoslavia in 1952–56 on *Cydia* (*Carpocapsa*) *pomonella* (L.), a serious pest of apple, showed that adults of the overwintered generation emerged in the second or third week of May, the threshold of pupal development being 9·6°C. [49·3°F.] and the sum of effective temperatures necessary for completion of the pupal stage being about 100°C. [180°F.]. The optimum mean temperature was 21–22°C. [69·8–71·6°F.], and emergence ceased if the average daily temperature fell below 11°C. [51·8°F.]. Adults of the two generations emerged over 83–93 days, until mid-August. The best times for spraying are discussed.

Bogavac (M.). **Autohtoni paraziti dudovca i njihova uloga u dinamici populacije ove štetočine.** [Indigenous parasites of *Hyphantria cunea* and their importance for the population dynamics of this pest.]—*Plant Prot.* no. 46 pp. 75–81, 3 figs., 8 refs. Belgrade, 1958. (With a summary in English.)

During investigations in 1953–57 in Vojvodina, Yugoslavia, 12 species of parasites were reared from *Hyphantria cunea* (Dru.) [*cf. R.A.E.*, A **43**

176]. No egg parasites were observed. Of those that attacked the larvae or pupae, *Compsilura concinnata* (Mg.) was the most effective, followed by *Pimpla turionellae* (L.) (*examinator* (F.)), and *Psychophagus omnivorus* (Wlk.), which was occasionally hyperparasitic. *Carcelia bombylans* R.-D. is recorded for the first time parasitising the larvae in Yugoslavia. The first generation of *H. cunea* was more severely parasitised (19–22 per cent.) than was the second (2–8 per cent.).

I Kongres stručnjaka za zaštitu bilja, 29-X—1-XI-1957. I. Opšti deo kongresa i fitopatološka sekcija. [First Congress of specialists in plant protection, 29-X—1-XI-1957. I. General part of the Congress and phytopathological section.]—*Plant Prot.* no. 47–48, 246 [+3] pp., 7 pls., 6 figs., 7 maps, refs. Belgrade, 1958.

The papers read in this section of a congress held in Yugoslavia in 1957 included two of entomological interest.

Todorović (S.). **Stanje i problemi zaštite bilja u Jugoslaviji** [The status and problems of plant protection in Yugoslavia], pp. 14–60, 1 fig., 7 maps (with a summary in English). This includes a review of the principal insects and other pests of crops and fruit and forest trees and their control.

Janežić (F.). **Rasprostranjenost vironosnih lisnih vašiju na krompiru u NR Sloveniji i njihov značaj za rejonizaciju semenskog krompira** [The distribution of aphid vectors of virus diseases in Slovenia and their importance for the siting of seed-potato production], pp. 113–117 (with a summary in English). Investigations on the intensity of infestation of potatoes by aphids in Slovenia were carried out in 1954–57 with a view to determining districts suitable for the production of virus-free seed potatoes. Five species were found on the crop, *Myzus persicae* (Sulz.), *Aphis nasturtii* Kalt. (*Doralis rhamni*, auct.) *A.* (*D.*) *fabae* Scop., *Macrosiphum euphorbiae* (Thos.) (*solanifolii* (Ashm.)) and *M. solani* (Kalt.) (*Myzus pseudosolani* Theo.), but the last three were too rare to be of importance in virus transmission. Special attention was paid to *Myzus persicae*. Infestation by this species was too low in 1954 for selection of districts, but differences were noted in the later years, and the infection rates for various places are given. It was found that the first peak of infestation occurred in the last 10 days of June if the spring was early and the first 10 days of July if it was late, and that there was a second peak in August–September.

Łarczenko (K. I.). **Warunki żywienia i diapauza stonki ziemniaczanej.** [Feeding conditions and the diapause in the potato beetle.]—*Roczn. Nauk roln.* **78** (A) pt. 1 pp. 1–25, 2 graphs, 13 refs. Warsaw, 1958. (With summaries in Russian & English.)

The following is based on the author's summary of this account of investigations in Poland. Changes in the nutritive value of potato leaves, and particularly an increase in their lipocytic coefficient, during the season lead to reductions in the number of females of *Leptinotarsa decemlineata* (Say) that complete their development in summer and in the period required for preparation for the winter diapause. The lipocytic coefficient serves as a measure of the degree of physiological preparation for the diapause and is lowest in young leaves and highest in old ones, and late-summer and autumn feeding is thus the most favourable for diapause preparation,

though this is also affected by other factors, such as weather, variety of potato and planting date.

Łarczenko (K. I.). **Długość rozwoju stonki ziemniaczanej w zależności od temperatury.** [The duration of development of the potato beetle in dependence on temperature.]—*Roczn. Nauk roln.* **78** (A) pt. 1 pp. 27–41. Warsaw, 1958. (With summaries in Russian & English.)

The following is based on the author's summary. The relation between temperature indices and the course of development of *Leptinotarsa decemlineata* (Say) was sufficiently close in Poland in 1952–55 for the phenology of the beetle to be accurately forecast. The overwintered adults leave the soil when the mean ten-day temperature reaches 11·5°C. [52·7°F.], the threshold of development, and oviposit when the sum of effective temperatures reaches 30°C. [54°F.], though variations may be caused by periods of cold weather. The duration of development of the subsequent generation depends on the amount of heat available, and the sums of effective temperature for the completion of the egg, larval and pupal stages are 80, 180 and 100°C. [144, 324 and 180°F.], respectively. The total of 360°C. was reached in 100–105 days in 1952, 55 days in 1953, 80 days in 1954 and 85 days in 1955. It is evident from these figures and field observations that the beetle may produce 1, 1½ or 2 generations a year, a sum of effective temperatures of 720°C. permitting the development of two. Adults of the second generation emerge at the end of August or the beginning of September.

Łarczenko (K. I.). **Fenologiczne terminy rozwoju stonki ziemniaczanej i związek ich z rozlotami i zmianami liczebności.** [Phenological periods of development in the potato beetle and their relation to dispersion and changes in number.]—*Roczn. Nauk roln.* **78** (A) pt. 1 pp. 43–58. Warsaw, 1958. (With summaries in Russian & English.)

The following is based on the author's summary. Consideration of the sum of effective temperatures during the potato-growing period and the dates of emergence of the adults in 1946–55 showed that 1–1½ generations of *Leptinotarsa decemlineata* (Say) develop in Poland in cool years and two in warm ones [*cf.* preceding abstract], except in the north and north-east, where there are never two complete ones. Temperature conditions permitted a great increase in the infested area in the west, centre and south in 1946–49 and further increases occurred in subsequent years. Spread is slower in the north, where the second generation dies before winter.

Łarczenko (K. I.). **Stawianie prognoz rozwoju stonki ziemniaczanej w Polsce.** [Forecasting the development of the potato beetle in Poland.] —*Roczn. Nauk roln.* **78** (A) pt. 1 pp. 59–78. Warsaw, 1958. (With summaries in Russian & English.)

Consideration of the sum of effective temperatures necessary for the development of *Leptinotarsa decemlineata* (Say) [*cf.* two preceding abstracts] showed that Poland could be divided into 5–6 climatic regions with respect to development of the beetle in 1954. These are discussed in detail.

Wilusz (Z.). **Z badań nad wiosennym rozlotem stonki ziemniaczanej.** [Studies on the spring migration of the potato beetle.]—*Roczn. Nauk roln.* **78** (A) pt. 1 pp. 79–94, 2 figs., 9 refs. Warsaw, 1958. (With summaries in Russian & English.)

Observations on the spring migration of the adults of *Leptinotarsa decemlineata* (Say) were made in Poland by liberating marked beetles, at the time of normal emergence from the soil, in the middle of three plots of potatoes 10, 50 and 100 m. square, situated in a field of beet that had not grown high enough to hinder movement; some were also released outside the largest square. It was found that migration depended on air temperature during the day and that night temperature had little effect. Activity was checked by rain. At low wind speeds, the flight was in the direction opposed to the wind, but there seemed to be a limit above which this direction was reversed. The maximum distance from which beetles crawled to potato plants did not exceed 50 m., but not all beetles liberated outside the plot moved in the direction of the potatoes. It is considered that a belt consisting of three rows of beet plants could protect a crop against beetles emerging within 50 m. of it.

Wilusz (Z.), Górny (M.), Narkiewicz-Jodko (J.) & Pacanowski (A.). **Dalsze badania nad mikromigracjami stonki ziemniaczanej** (*Leptinotarsa decemlineata* **Say**). [Further studies on the micromigrations of the potato beetle (*L. decemlineata*).]—*Roczn. Nauk roln.* **78** (A) pt. 1 pp. 95–122, 13 figs., 24 refs. Warsaw, 1958. (With summaries in Russian & English.)

The following is based on the authors' summary. Studies were begun in the Poznan district of Poland in 1955 on the relation of the migrations of the spring and summer adults of *Leptinotarsa decemlineata* (Say) to microclimate and phenological conditions. It was found that migration to potatoes occurs by crawling and by flight, depending on the distance and climatic conditions. Potato fields at some distance from the points of emergence from the soil or surrounded by trees were attacked later than those close to the emergence sites, and the plants nearest to these were always attacked first. The largest numbers were observed on potato fields in open areas with an aerated soil, close to sites of infestation in the previous year. Flight took place both with and against the wind, and summer beetles migrated less than spring ones, usually remaining in the field in which they had developed, even though the plants were in a less favourable condition than those in neighbouring fields. The ratio of males to females was 1 : 2·3 for the spring generation and 1 : 1·8 for the summer one.

Stacherska (B.) & Szczepanska (K.). **Badania nad toksycznymi własnościami azotniaku dla stonki ziemniaczanej** (*Leptinotarsa decemlineata* **Say**). [Studies on the toxicity of calcium cyanamide to the potato beetle (*L. decemlineata*).]—*Roczn. Nauk roln.* **78** (A) pt. 1 pp. 141–157, 2 figs., 17 refs. Warsaw, 1958. (With summaries in Russian & English.)

The following is based on the authors' summary. Laboratory experiments in Poland showed that calcium cyanamide has a systemic toxic action on first-instar larvae of *Leptinotarsa decemlineata* (Say) feeding on potato plants grown in pots in water culture treated with it at 475 and 1,350 lb.

per acre or in sand culture treated at 337·5–1,350 lb. per acre; there was no effect when the plants were growing in soil either in the laboratory or in the field, and soil treatment had no effect on hibernating adults. Dusts of calcium cyanamide at 36 lb. per acre caused complete kill of larvae and over 50 per cent. mortality of adults in the laboratory, but damaged 20 per cent. of the plants. When applied as a dust to plots at the end of August, calcium cyanamide at 180 lb. per acre killed 64 per cent. of the summer adults and caused complete drying up of the plants. It is concluded that other insecticides offer more promise.

Ląkocy (A.). **Wpływ opylania Gesarolem larw stonki ziemniaczanej w stadium L_4 na rozwój chrząszczy.** [Dusting fourth-instar larvae of the potato beetle with DDT and its effect on the development of the beetles.]—*Roczn. Nauk roln.* **78** (A) pt. 1 pp. 177–180, 1 graph. **Warsaw, 1958.**

When fourth-instar larvae of *Leptinotarsa decemlineata* (Say) were dusted with DDT, the treatment had no effect on the subsequent duration of development of the survivors, but the mortality rate of the resulting adults was increased, whether they were fed or not, and the females laid more eggs than did untreated beetles.

Daszkiewicz-Hubicka (J.). **Porównawcze badania nad niektórymi danymi z biologii *Meromyza saltatrix* L. i *Chlorops pumilionis* Bjerk.** [Comparative investigations on some facts in the bionomics of *M. saltatrix* and *C. pumilionis*.]—*Ann. Univ. M. Curie-Skłodowska* (C) **13** (1958) no. 2 pp. 5–40, 6 figs., 4 graphs, 1 fldg. table, 16 refs. Lublin, 1959. (With summaries in Russian & German.)

Cereal crops in Poland are infested by *Meromyza saltatrix* (L.) and *Chlorops pumilionis* (Bjerk.). Since these Chloropids have not been sufficiently differentiated in the past, the author describes all stages of each of them and records observations on their bionomics on wheat and barley near Lublin, carried out in 1953–57. It was found that both have two generations a year [*cf. R.A.E.*, A **19** 384]. The adults of the overwintered generation of *M. saltatrix* oviposited on the leaves of the two crops in June, and those of the first generation in mid-September, after a diapause in August. Thus, larvae of the second generation develop in unfavourable conditions, and infestation tends to be sporadic. Damage was confined to the ears. The main damage is caused by the summer generation of *C. pumilionis*, which injured both stems and ears.

Bogdanow (W. T.). *Bothynoderes punctiventris* **Germ. Cz.1. Biologia i gospodarcze znaczenie w Bułgarii.** [*Cleonus punctiventris*. Part 1. Bionomics and economic importance in Bulgaria.]—*Ann. Univ. M. Curie-Skłodowska* (C) **13** (1958) no. 3 pp. 41–83, 8 figs., 35 refs. Lublin, 1959. (With summaries in Russian & German.)

A detailed account is given of investigations carried out in Bulgaria in 1954–58 on the bionomics of *Cleonus* (*Bothynoderes*) *punctiventris* (Germ.), which was first recorded there in 1922–23 and has since become the most injurious pest of beet; all stages of the weevil are described, and its food-plants are tabulated. The adults overwintered in the pupal chambers in the upper foot of soil, came to the surface in the first

half of April, as soon as the soil temperature rose above 6°C. [42·8°F.], and migrated to fields of beet. Pairing and oviposition occurred at the end of April and the beginning of May, pairing taking place 19–21 days after flight, and oviposition 3–5 days later. The optimum temperatures were 22–25°C. [71·6–77°F.] and 27·5–34·2°C. [81·5–93·6°F.], respectively. Oviposition continued for 30–60 days, and occurred under the top layer of soil. Up to 178 eggs were laid per female, with an average of 94. In the laboratory, the optimum conditions for hatching were 25°C. and 50 per cent. relative humidity, at which the eggs hatched in an average of 6–8 days. The larval stage averaged 45 days and was completed as early as mid-June, when the first pupae appeared. The pupal stage lasted 12–15 days, and the adults overwintered in the pupal chambers. There was only one generation a year. *Brachymeria femorata* (Panz.) and *Muscina assimilis* (Fall.) were found parasitising the adult weevils, and numerous insect predators attacked the larvae and adults. Diseases caused by fungi were noted, but none was of great importance. The main causes of the severity of the infestation are considered to be favourable climatic conditions, sowing of beet in the same fields without crop rotation, inappropriate or inadequate control measures, insufficient attention to parasites and biological control, and little clearing of weeds. Notes on less important pests are included.

Miczulski (B.). **Materiały do znajmości pasożytów niestrzępa głogowca *Aporia crataegi* (L.).** [Contributions to knowledge of insect parasites of the pupae of *A. crataegi*.]—*Ann. Univ. M. Curie-Skłodowska* (C) **13** (1958) no. 8 pp. 131–141, 13 refs. Lublin, 1959. (With summaries in Russian & English.)

Aporia crataegi (L.) was numerous on hawthorn [*Crataegus*] near Lublin, Poland, in 1954–57, and observations showed that reductions in the population were due mainly to parasites of the pupae, though these did not multiply fast enough to afford much control. The parasites reared were *Pimpla instigator* (F.), *Apechthis compunctor* (L.) (*P. brassicariae* (Poda)), *Theronia atalantae* (Poda), *Blondelia* (*Ceromasia*) *nigripes* (Fall.) and (in 1956 only) *Monodontomerus aereus* Wlk. *T. atalantae* and *M. aereus* occurred as both primary and secondary parasites.

Ivancheva-Gabrovska (T.). **Tomato spotted wilt (*Lycopersicum* virus 3 Smith) on tobacco in Bulgaria.** [*In Bulgarian.*]—*Nauch. Trud. Minist. Zemed. nauch. Inst. Zasht. Rast.* **2** pp. 5–32, 10 pls. (1 col.), 39 refs. Sofia, 1959. (With summaries in Russian & English.)

A virus subsequently identified as tomato spotted wilt was found on tobacco in southern Bulgaria for the first time in 1952 and spread to almost all the tobacco-growing areas in the next five years. It was not seed-borne and could not be transmitted mechanically. In tests with insects, *Myzus persicae* (Sulz.) failed to transmit the virus, but *Thrips tabaci* Lind. proved to be a vector, effecting transmission from diseased to healthy tobacco after feeding on the latter for eight or more minutes, though not after feeding for five minutes or less. The thrips is widespread on tobacco in Bulgaria. In a preliminary test on its control, 12 per cent. BHC was introduced at a rate equivalent to 45 lb. per acre into the upper 4-in. layer of soil in the seed-beds before sowing and the young plants were treated monthly with a spray of 0·04–0·05 per cent. parathion or a dust of 5 per cent. DDT. Only 0·27–1·62 per cent. of them became infected, as compared with 12·28

per cent. in untreated beds. At transplanting, the soil was treated as above and the plants were dusted or sprayed as before, and the latter treatments were repeated 3–4 times at ten-day intervals. As a result, the percentage infection was reduced from 70–80 to 5–8. When applied in severely affected districts, these control measures resulted in only 1–2 per cent. infection of the plants.

Popov (P. A.). **Studies of the bionomics of June beetles** (*Amphimallon*) **in Bulgaria and their control.** [*In Bulgarian.*]—*Nauch. Trud. Minist. Zemed. nauch. Inst. Zasht. Rast.* **2** pp. 33–74, 17 figs., 15 refs. Sofia 1959. (With summaries in Russian & English.)

The species of *Amphimallon* that occur in Bulgaria are *A. caucasicum* (Gylh.), *A. solstitiale* (L.) and *A. assimile* (Hbst.). The first is by far the most widespread, and it injures the roots of many field crops. *A. solstitiale* is also common but causes much less damage, since the larvae normally feed on the roots of wild grasses, and *A. assimile* is restricted to the south-west and is of no economic importance. All stages of the first and some stages of the other two are described, and the results are given of investigations carried out in 1951–57 on their bionomics and control.

All had two-year life-cycles. The adults of *A. caucasicum* emerged from mid-June to early July. The flight lasted 12–36 days and was more prolonged and intense during rainy weather. Pairing occurred immediately after emergence, and the foci of infestation remained constant, as the females do not fly. Oviposition began 7–8 days after emergence, at the beginning of July, and 2–41 eggs were laid per female, with an average of 17·6. They were deposited singly at depths of 1·25–6 in. The eggs hatched in about 25 days at 19–20°C. [66·2–68°F.] in the laboratory and in about 22–24 days in the field at 21–22°C. [69·8–71·6°F.]. The larvae did not feed until after the first moult and were most injurious after the second. They attacked the roots of numerous plants but preferred wheat, vetch (*Vicia sativa*) and onions. The larval stage lasted 21·5–22·5 months. Pupation took place in a soil chamber, and the pupal stage lasted 24–26 days. The bionomics of *A. solstitiale* were similar, but the eggs were laid at slightly greater depths and the females deposited up to 55 each. The adults of *A. assimile* emerged in the last ten days of June and fed on the needles of coniferous trees, and eggs were laid at depths of 0·8–4·8 in. in the soil. The adults of *A. caucasicum* and *A. solstitiale* were more numerous in odd-numbered years, and those of *A. assimile* in even-numbered ones.

Control measures were tested mainly against the larvae and to some extent against the adults of *A. caucasicum* and *A. solstitiale*. Soil cultivation and deep ploughing proved very effective. Spraying the soil with 0·03–0·05 per cent. parathion gave complete mortality of the larvae reached by the liquid, treatment of the soil with 12 per cent. BHC at 117–153 lb. per acre to depths of 5·4–8·8 in. gave complete kill of first- and second-instar larvae, and similar results were obtained with dieldrin at 54–72 lb. per acre.

Bogdanov (V. T.) & Tsonkovski (K. M.). **Contribution to control measures against** *Eulecanium corni* **Bouché in Bulgaria.** [*In Bulgarian.*]—*Nauch. Trud. Minist. Zemed. nauch. Inst. Zasht. Rast.* **2** pp. 75–105, 2 figs., 3 refs. Sofia, 1959. (With summaries in Russian & German.)

An account is given of experiments in Bulgaria in 1951–57 in which numerous chemicals, including several proprietary materials of unspecified

composition, were tested for their effectiveness against *Eulecanium corni* (Bch.) on plum. Those that proved satisfactory in winter sprays included preparations of DNC, notably Selinon at 1 per cent., which could be used at temperatures of 0°C. [32°F.] or below. In spring, sprays of parathion, DDT or oil emulsion proved satisfactory, and in summer, when the crawlers were spreading over the trees, good results were given by parathion, methyl-parathion (Wofatox), DDT, demeton (Systox), methyl-demeton (Metasystox) and malathion, and a methyl-parathion dust was also effective.

Nikolova (V.), Kirkov (K.), Vartanyan (A.) & Danova (D.). **The effect of BHC on maize, sunflower, beet and tobacco when introduced into the soil or used for seed dusting.** [*In Bulgarian.*]—*Nauch. Trud. Minist. Zemed. nauch. Inst. Zasht. Rast.* **2** pp. 107–123, 8 refs. Sofia, 1959. (With summaries in Russian & German.)

The following is substantially the authors' summary. When 12 per cent. BHC dust was introduced into the soil in Bulgaria against insect pests, including wireworms, at rates of 45, 72 and 108 lb. per acre, the yield of maize was not reduced, except by the two higher rates, and the yield and quality of tobacco was normal. Treatment of the seeds with 12 per cent. BHC had no effect on the yield of maize at up to 2 per cent. by weight or of sunflower [*Helianthus*] at up to 4 per cent., but this last caused a slight reduction in the yield of sugar-beet.

Fedorov (S. M.). **Biological bases of control of the vine** *Phylloxera*. [*In Russian.*]—*Rev. Ent. URSS* **38** pt. 1 pp. 82–97, 3 figs., 23 refs. Moscow, 1959. (With a summary in English.)

The author reviews the forms and annual cycle of development of *Phylloxera* (*Dactylosphaera*) *vitifoliae* (Fitch) on vines and points out that existing methods of control are unsatisfactory. Individual plants and strains of European vines in the south-west of the Soviet Union have been found to survive prolonged infestation, and one promising method of control might be to breed resistant strains by clonal selection.

Minder (I. F.). **Leaf-rollers injurious to fruit crops in the flood-plain of the Oka river.** [*In Russian.*]—*Rev. Ent. URSS* **38** pt. 1 pp. 98–110, 8 figs., 16 refs. Moscow, 1959. (With a summary in English.)

In investigations in 1954–55 in the valley of Oka, to the south of Moscow, 15 species of leaf-rolling Tortricids were found on fruit and other deciduous trees and fruits. *Archips* (*Cacoecia*) *rosanus* (L.), *Pandemis ribeana* (Hb.) and *Spilonota* (*Tmetocera*) *ocellana* (Schiff.) comprised 73·7, 6·2 and 5·5 per cent. of the adult population, respectively, and observations on the bionomics of these three on apple are described.

The overwintered eggs of *A. rosanus*, which were found on the trunk 4–6 in. from the ground, hatched 18 days after the mean daily temperature had exceeded 8°C. [46·4°F.], and hatching was completed in 8–9 days. The larvae ascended the trees and fed on buds, leaves and flowers and also damaged the fruits. The larval stage lasted 40–60 days and was usually completed by late June or early July. Pupation took place in the rolled

leaves, and the pupal stage lasted 10–14 days. Mass flight and oviposition occurred 5–7 days after adult emergence had begun, and lasted 7–8 days. The females laid 124–173 eggs each, with an average of 147. *A. rosanus* fed on all the plants examined, but showed a marked preference for apple and black currant in tests; when provided with leaves of these, 90 and 88 per cent., respectively, of the larvae pupated, as compared with lower percentages on other leaves. *P. ribeana*, which was also polyphagous, overwintered as third-instar larvae in cocoons, mostly on the trunks 4–20 in. above the ground. The larvae resumed activity in the first ten days of May, when the mean daily temperature reached 10–14°C. [50–57·2°F.] and fed on buds, young leaves and blossoms for 2–3 weeks. Pupation occurred from mid-June to the end of July, and the pupal stage lasted 10–17 days. Adults were present for about two months, but mass flight lasted for only 10–12 days; 284–357 eggs were laid per female, with an average of 313. The larvae hatched in 8–18 days, fed on the lower surface of the leaves for about a month and then spun winter cocoons. *S. ocellana* was observed only on apple. Its bionomics were similar to those of *P. ribeana*, but the females laid 150–210 eggs each and the larvae fed up to two months before hibernating.

From eggs, larvae and pupae of the Tortricids, 48 species of parasites were reared; parasitism in one year was as high as 59·6 per cent. Most of the parasites (32 species) were Ichneumonids, and of these the most important was *Angitia fenestralis* (Holmgr.), which attacked the young larvae. *Trichogramma* sp. parasitised a high proportion of the eggs of *Archips rosanus*. Control measures are briefly reviewed.

Meĭrmanov (E.). *Eurydema wilkinsi* **Dist. (Hemiptera, Pentatomidae) as a pest of cabbage in the Kzyl-Orda region.** [*In Russian.*]—*Rev. Ent. URSS* **38** pt. 1 pp. 111–118, 8 refs. Moscow, 1959. (With a summary in English.)

The bionomics of *Eurydema wilkinsi* Dist., an injurious pest of cabbage and radish in southern Kazakhstan, were studied in 1956–57. The Pentatomid fed only on crucifers, but attacked wild and cultivated species. The overwintered adults appeared at the end of March or the beginning of April, when the mean daily temperature fluctuated between 6 and 10°C. [42·8–50°F.], and fed on wild crucifers for 1–2 weeks. Pairing occurred after 10–12 days, and mass oviposition was observed at the end of April and throughout May. The eggs were deposited in batches of about 12 on leaves, stems, the soil or débris, and occasionally at some distance from the food-plants. The eggs hatched in 10–15 days at 9·9–20·1°C. [49·8–61·2°F.] and 35–45 per cent. relative humidity in the field, and in 6–9 days at 19·3–25·6°C. [66·7–78·1°F.] and 38–50 per cent. relative humidity, in 4–5 days at 26°C. [78·8°F.] and in 2 days at 28°C. [82·4°F.] in the laboratory. The first adults of the new generation appeared at the end of May, and those of subsequent ones in mid-July and at the end of August; those of the last overwintered under débris in the fields. The bugs migrate to cultivated crucifers as soon as these are available, and a cage test showed that about 38, 75 and 100 per cent. loss of cabbages resulted from the feeding of three, six or 12 insects per plant, respectively. For control, crop remains under which the bugs overwinter should be removed, and the bugs should be collected from wild crucifers in early spring. In a preliminary test, dusts of 5 and 12 per cent. DDT gave good control on heavily infested cabbage.

Petrova (I. A.). **A contribution to the bionomics of** *Saperda carcharias* **L. (Coleoptera, Cerambycidae).** [*In Russian.*]—*Rev. Ent. URSS* **38** pt. 1 pp. 119–128, 1 graph, 11 refs. Moscow, 1959. (With a summary in English.)

Investigations on the bionomics of *Saperda carcharias* (L.), boring in the trunks of poplar in the Savala valley, in the Voronezh region [*cf. R.A.E.*, A **49** 289], showed that the life-cycle of this Lamiid lasts four years. The eggs are laid in July–August and hatch in late April or May of the following year, and the larvae require three years for their development, which is continuous; those in the fourth instar prepare pupal cells, in which they overwinter. They pupate in May, and the adults emerge in July. The eggs are laid singly under the bark, each female depositing 50–60. Some authors have recorded a shorter life-cycle, and in that connection it is noted that larvae parasitised by *Pyracmon* (*Rhimphoctona*) *fulvipes* Hlmgr. prepare pupal chambers before dying, irrespective of their age at the time. Mortality of first- and second-instar larvae was very high, which accounted for the small number of adults observed.

Yakovlev (B. P.). **A contribution to the bionomics of the gall-midge** *Kaltenbachiella strobi* **Winn. (Diptera, Itonididae), injurious to spruce cones.** [*In Russian.*]—*Rev. Ent. URSS* **38** pt. 1 pp. 129–134, 6 figs., 4 refs. Moscow, 1959. (With a summary in English.)

Investigations were carried out in 1952–53 in southern Karelia, in the north-west of the Soviet Union, on the bionomics of *Kaltenbachiola* (*Kaltenbachiella*) *strobi* (Winn.), which was found commonly infesting the cones of spruce. The adults of this Cecidomyiid emerged between 15th May and 15th June, when the mean daily temperature reached 20–24°C. [68–75·2°F.]. In the laboratory, pairing and oviposition took place 3–4 hours after emergence, and the adults lived for only four days. The eggs were laid on the inner surface of the scale bases of young cones, singly or in groups of 2–3, and the larvae mined in the scales, causing the formation of galls not visible externally. Pupation occurred in the galls in the following spring. Of 1,053 cones examined, all were infested and 7 per cent. contained no less than 50 pupae each [*cf. R.A.E.*, A **23** 519]. Parasitism of *K. strobi* was very high. The most important parasites were *Torymus* (*Callimome*) *azureus* Boh., which emerged from the cocoons, and a Proctotrupid that oviposited in the eggs, completed its development in the larvae and emerged from the cocoons of the Cecidomyiid.

Beglyarov (G. A.). **On the bionomics of the hawthorn mite** *Tetranychus crataegi* **Hirst (Acariformes, Tetranychidae).** [*In Russian.*]—*Rev. Ent. URSS* **38** pt. 1 pp. 135–144, 2 figs., 31 refs. Moscow, 1959. (With a summary in English.)

The author reviews the Tetranychoid mites that occur on apple in the Krasnodar region of the Soviet Union and their increased importance [*cf. R.A.E.*, A **48** 407] and records investigations in the laboratory and field in 1954–57 on the bionomics of *Tetranychus viennensis* Zacher (*crataegi* Hirst). All stages of this mite are described, and its synonyms [*cf.* **44** 19] are stated to include *T.* (*Apotetranychus*) *virginis* (Ugar.) [**26** 530]. The

following is largely the author's summary of the work. In addition to apple, the mite was found on numerous other fruit trees and related plants and on herbaceous weeds growing in orchards, but the latter were only occasionally infested. The overwintering females were bright red in colour. They were fertilised in autumn and overwintered under detached bark on the trees, in the soil and under fallen leaves. From mid-April to the beginning of May, they ascended the trees, feeding on buds and young leaves, and they oviposited 15–20 days later. There were eight complete and one partial generation in the year, and all stages were present simultaneously, the last adults appearing in September. In the laboratory at 22·5–25°C. [72·5–77°F.], a generation was completed in 12–14·5 days, the egg, larval and nymphal stages lasting 4–5, 1–2 and 2·5–3 days, respectively, and the preoviposition period lasting 1–5 days. The females laid an average of 70–82 eggs each, and those of the last generation died with the first frost if they began oviposition before hibernation. In general, winter mortality was high, so that the spring population was low, despite development of large numbers of mites in late summer and autumn.

Pope (R. D.). *Aserica, Autoserica, Neoserica,* **or** *Maladera?* (**Coleoptera: Melolonthidae.**)—*Ann. Mag. nat. Hist.* (13) **3** (1960) pp. 545–550. London, 1961.

This paper was written to establish the correct name for the Melolonthid known in the United States as the Asiatic garden beetle, which was originally described by Arrow in 1913 from Japan as *Autoserica castanea* and has since been referred to as *Aserica castanea* (Arr.) and as *Autoserica* or *Maladera japonica* (Motsch.). From a study of the history of the genera concerned, which is set out in detail, and examination of numerous species at present placed in *Maladera, Serica, Autoserica* and *Aserica* (including the type species of the first and last), the author concludes that *Aserica* (type species *Autoserica secreta* Brenske), *Autoserica* (type species *Serica piceorufa* Fairm.) and *Neoserica* (type species *Serica ursina* Brenske, by present selection) are congeneric with *Maladera* (type species *Scarabaeus holosericeus* Scop.*). There was sufficient variation in tibial expansion to discredit this character as a means of distinguishing between *Serica* and *Maladera*, but the separation of the middle coxae of all the species of *Maladera* examined was distinctly greater than that for true species of *Serica*. *M. castanea* is distinct from the true *S. japonica* Motsch., but the latter can be included without difficulty in *Maladera*. It would appear that records of *M. japonica* from Transcaucasia [*R.A.E.*, A **22** 172; **45** 475] refer to *M. castanea*.

Distribution maps of pests.—Series A (Agricultural), nos. 121–129. London, Commonw. Inst. Ent., 1961. **Index to maps 1–129.** 1961.

The maps are nos. 121–129 of a series already noticed [*R.A.E.*, A **40** 203; **49** 2] and deal, respectively, with *Maladera castanea* (Arr.), *Hyphantria cunea* (Dru.), *Prays oleellus* (F.), *Myiopardalis pardalina* (Big.), *Dacus zonatus* (Saund.), *Therioaphis maculata* (Buckt.), *Acceria sheldoni* (Ewing), *Brevipalpus obovatus* Donn. and *Cecidophyes ribis* (Westw.). The index includes both popular and scientific names.

* We are requested by the author to point out that his citation of this species as *Scarabaeus holosericeus* L. was a *lapsus calami.—Ed.*

Symposium on metabolism of insecticides.—*Canad. J. Biochem. Physiol.* **37** pp. [1+] 1091–1151, 5 figs., many refs. Ottawa, 1959.

Apart from a brief introduction by E. Y. Spencer, nine papers were read at this symposium, which was held in Canada in 1958. They comprise: **Insecticide resistance as a world problem,** by A. W. A. Brown (pp. 1091–1097, 85 refs.), which is a review of the literature, largely as regards insects of medical importance; **Mechanisms of resistance to chlorinated hydrocarbons,** by H. H. Moorefield (pp. 1099–1103, 34 refs.), in which the metabolism of chlorinated-hydrocarbon insecticides by insects is reviewed from the literature; **Control of animal parasites with systemic insecticides,** by D. G. Peterson & A. A. Kingscote (pp. 1105–1112, 1 fig., 65 refs.), which is concerned with pests of livestock; **Comparative toxicology of some organophosphorus compounds in insects and mammals,** by R. D. O'Brien (pp. 1113–1122, 3 figs., 12 refs.), which is a discussion of the selective toxicity to insects of certain phosphorus insecticides, the factors responsible for it and the development of further compounds of this nature; **Enzyme relationships in the action of organophosphorus insecticides,** by B. N. Smallman (pp. 1123–1126, 17 refs.), in which the prevailing view that the toxicity of phosphorus insecticides is due to their inhibiting cholinesterase is discussed and attention is drawn to the importance of the simultaneous increase in acetylcholine that occurs in poisoned insects; **Physiological events in organophosphorus poisoning,** by E. H. Colhoun (pp. 1127–1134, 1 graph, 26 refs.), which is a review of work, mostly by the author and not all published, on the effects of poisoning by organophosphorus compounds on *Periplaneta americana* (L.), with special reference to the increase in acetylcholine that results and the reactivation of inhibited cholinesterase by pyridine 2-aldoxime methiodide (PAM); **The ovicidal action of organophosphate insecticides,** by E. H. Smith & A. C. Wagenknecht (pp. 1135–1144, 31 refs.), which is a discussion of the view that inhibition of cholinesterase is responsible for the toxicity of phosphorus insecticides to insect eggs; **Significance of plant metabolites of insecticides,** by E. Y. Spencer (pp. 1145–1150, 14 refs.), which is a review of the metabolism of insecticides, notably the phosphorus compounds, in plants, sometimes to more toxic compounds; and **Trends in insecticidal chemicals: a summary,** by Hubert Martin (p. 1151), in which the development of insecticides according to chemical or physiological principles is briefly surveyed.

Metcalf (R. L.). Ed. **Advances in pest control research. Volume IV.**—$9\frac{1}{4} \times 6$ in., vii + 347 pp., 26 figs., many refs. New York, N.Y. & London, Interscience Publishers, Inc., 1961. Price £4 14*s*.

The articles in this fourth volume of a series [*cf. R.A.E.*, A **48** 283, etc.] include: **Some fundamental aspects of applied insect pathology,** by I. M. Hall (pp. 1–32, 13 figs., 42 refs.), in which the topics discussed are, notably, the production of micro-organisms pathogenic to insects, the determination of their effectiveness, field testing, the compatibility of micro-organisms with adjuvants and chemical insecticides, factors that influence effectiveness in the field, and the practical use of micro-organisms against pests of crops; **Synthetic pyrethroids,** by W. F. Barthel (pp. 33–74, 143 refs.), which is a review of the chemistry, toxicology and effectiveness against insects of synthetic insecticides related to the pyrethrins, notably allethrin and its analogues (which include furethrin and cyclethrin), barthrin (6-chloropiperonyl chrysanthemate), and the 2,4- and 3,4-dimethylbenzyl chrysanthemates; **Selective toxicity of insecticides,** by R. D. O'Brien (pp. 75–116,

3 figs., 97 refs.), in which the author discusses the factors responsible for the differences in toxicity of selective insecticides, chiefly organophosphorus compounds, to the insects that they are designed to kill and other organisms, such as man and domestic animals; **Potentiation of the toxicity of organophosphorus compounds,** by K. P. Dubois (pp. 117–151, 3 graphs, 12 refs.), in which the author records numerous laboratory experiments on the possible synergistic effects to be obtained by administering organophosphorus insecticides in pairs, states that four such combinations, malathion with EPN, trichlorphon (Dipterex) or coumaphos (Co-Ral), and trichlorphon with azinphos-methyl (Guthion), produce such an effect on acute toxicity to rats, though tri-o-tolyl phosphate also had a synergistic effect on malathion, and discusses the mechanisms responsible; **Residue determination by cholinesterase inhibition analysis,** by J. C. Gage (pp. 183–210, 7 figs., 24 refs.), which is largely a review of methods, techniques and underlying principles; and **A digest of available information on the insecticide malathion,** by D. Spiller (pp. 249–335, 658 refs.), in which the author deals mainly with the properties of malathion and its use for the control of insects and mites. In addition to a subject index to the volume, there is a cumulative index to the articles in the four volumes so far published.

Coulon (J.). **Essais au laboratoire des substances acaricides. Méthode d'étude des actions ovicides.**—*Ann. Épiphyt.* **9** (1958) no. 4 pp. 497–516, 10 graphs, 10 refs. Paris, 1959.

The author describes a method of testing ovicides against the eggs of *Tetranychus telarius* (L.), laid on bean cotyledons, by spraying the infested plants on a turntable. The plants are placed in a spray tower, the cotyledons are supported in a horizontal position, and the spray is directed downwards on to them until the droplets coalesce, when spraying ceases; the resulting deposit is about 6 mg. per sq. cm. Mortality is calculated eight days after the eggs were laid, by means of Abbott's formula [*R.A.E.*, A **13** 331], and the LD50's are compared with that given by a standard preparation (chlorobenzilate). The method was used to compare various products in tests already noticed [**49** 92], and proved satisfactory for most purposes, though it did not differentiate between compounds of very similar toxicity.

Miles (P. W.). **The salivary secretions of a plant-sucking bug, *Oncopeltus fasciatus* (Dall.) (Heteroptera: Lygaeidae). I. The types of secretion and their roles during feeding.**—*J. Insect Physiol.* **3** no. 3 pp. 243–255, 2 pls., 1 fig., 21 refs. London, 1959.

The following is virtually the author's abstract. *Oncopeltus fasciatus* (Dall.) secretes two types of saliva: sheath-material, which coagulates rapidly and forms a lining to the path of the stylets when the insect feeds on natural food materials, and a watery and water-soluble saliva, which is secreted and sucked back again both on the surfaces of substrates and within them. *Dysdercus fasciatus* Sign. secretes both types of saliva in a similar manner. In agar gels containing sucrose or homogenised groundnuts, *Oncopeltus* deposits watery saliva, some of which is sucked back several minutes after secretion. During this process, substances are leached from the medium and starch grains are broken down by an amylase. The course of feeding in both natural and artificial media is described. It is suggested that, once feeding has begun, the secretion of watery saliva is

inhibited by the flow of liquids up the food-canal; that stylet-activity is inhibited by the presence of acceptable substances in these liquids, but that cessation of the inhibition can be brought about by sensory adaptation; and that the secretion of sheath-material is elicited by resistance to the passage of the stylets, but that the rate of flow is uncontrolled and only a limited amount can be secreted continuously. The functions of the salivary secretions are considered, with reference to the feeding of the phytophagous Hemiptera generally.

Moriarty (F.). **The 24-hr rhythm of emergence of *Ephestia kühniella* Zell. from the pupa.**—*J. Insect Physiol.* **3** no. 4 pp. 357–366, 1 graph, 12 refs. London, 1959.

The following is virtually the author's abstract. The endogenous 24-hr. emergence rhythm of *Anagasta* (*Ephestia*) *kühniella* (Zell.) was unaffected by a daily variation of atmospheric pressure or humidity. Decrease in temperature from 30 to 25°C. [86 to 77°F.] initiated a new rhythm of emergence; the opposite change did not affect the existing emergence rhythm. A change from light to darkness stimulated emergence; a change from darkness to light retarded it. A single decrease of temperature or change of light intensity initiated a new rhythm of emergence. A 16-hr. periodicity of emergence was initiated by a corresponding periodicity of temperature, but the rhythm reverted to a 24-hr periodicity immediately the temperature variations ceased. No 24-hr. rhythm of oxygen consumption by the pupa in uniform conditions could be detected. The time between peak periods of emergence appeared to increase when pupae were kept in constant conditions in a gas mixture containing 7 per cent. oxygen. The endogenous emergence rhythm was displaced by about 12 hr. after pupae had been kept at 0·5°C. [32·9°F.] for 12 hr.

Johnson (B.). **Studies on the degeneration of the flight muscles of alate aphids. II. Histology and control of muscle breakdown.**—*J. Insect Physiol.* **3** no. 4 pp. 367–377, 2 pls., 11 refs. London, 1959.

The following is mainly the author's abstract of this second part of a series [*cf. R.A.E.*, A **47** 114]. Within a few days of settling down on a food-plant, alate aphids of most species undergo a change in metabolism that becomes manifest in breakdown of the flight muscles, resumption of embryo development in the ovarioles, and hypertrophy of the fat-body. In this paper, an account is given of investigations carried out mainly with *Macrosiphum* (*Acyrthosiphon*) *pisum* (Harris) on young broad-bean plants (*Vicia faba*) on the histology of flight-muscle breakdown, and experimental evidence is presented suggesting that the change in metabolism in the aphid is brought about by the secretion of a hormone. Muscle breakdown and fat-body hypertrophy could be initiated in aphids in response to abnormal afferent stimuli, as when aphids were tied down on inert surfaces.

Foott (W. H.). **A strain of the European red mite, *Panonychus ulmi* (Koch) (Acarina: Tetranychidae), resistant to ovex in southwestern Ontario.**—*Canad. J. Pl. Sci.* **40** no. 3 pp. 542–545, 4 refs. Ottawa, 1960.

The following is based almost entirely on the author's abstract. The development of a strain of *Panonychus ulmi* (Koch) resistant to chlorfenson

(ovex) was indicated in 1956–57 after this material had been used for seven years against the mite in an apple orchard in south-western Ontario. In the laboratory in 1958, the ability of eggs to hatch after treatment with chlorfenson was significantly higher at the 1 per cent. level when the females that laid them originated on trees that had been sprayed with chlorfenson than when they were collected on trees that had never been sprayed with this material. Decreases in percentage hatch associated with increases in concentration of chlorfenson were not sufficient to warrant attempts to control the resistant strain by increasing the rate of application.

Harcourt (D. G.). **Note on a virus disease of the cabbage looper in the Ottawa Valley.**—*Canad. J. Pl. Sci.* **40** no. 3 pp. 572–573, 1 pl., 6 refs. Ottawa, 1960.

A strain of *Trichoplusia ni* (Hb.) resistant to DDT appeared in the Ottawa Valley in 1955 and severely damaged cabbage crops in eastern Ontario and western Quebec [*cf. R.A.E.*, A **46** 192]. This species was again numerous in 1957, and a light outbreak occurred throughout eastern Ontario in 1959, when numbers at Ottawa were four times the average. During observations in Quebec in 1959, last-instar larvae of the second generation were observed on 10th September to be suffering from a virus disease. Between 11th and 24th September, the percentage infected increased from 60 to 100, on 28th September 42 per cent. of the young larvae of the third generation showed symptoms, and by mid-October all larvae of this generation were infected. The dead larvae contained numerous polyhedra of a virus that attacked the nuclei of the fat-body, connective tissue, hypodermis, blood and tracheal matrix. The disease, which was widespread in two counties in western Quebec and two in Ontario, has apparently not previously been reported in Canada, though one with similar symptoms is of importance in the United States [*cf.* **48** 23, etc.]. Its sudden appearance is attributed to temperatures 9·8°F. above normal during the first ten days of September.

Read (D. C.) & Lelacheur (K. E.) **Note on the effectiveness of insecticides applied to mineral soils of various levels of acidity, with and without lime applications at time of seeding, in controlling root maggots attacking rutabagas.**—*Canad. J. Pl. Sci.* **40** no. 3 pp. 578–579. Ottawa, 1960.

The influence of the pH value of soil on the effectiveness of parathion and heptachlor applied to it against *Hylemyia brassicae* (Bch.) attacking swedes was investigated on Prince Edward Island in 1959 on light loam soils that had been dressed with lime at five-yearly intervals from 1941 onwards at rates of up to 4,000 lb. per acre. Half the plots received further dressings, at the same rates, immediately before sowing. The seed was sown and the insecticides applied on 15th June, and the number of larval mines per plant and the degree of root damage were assessed on 15th October, when the pH values of the soil were found to vary from 5 to 6·68. The control afforded by the treatments did not differ significantly, but heptachlor was more effective where lime had not been applied, and parathion gave somewhat superior control where it had. The highest yields and least damaged roots were obtained from plots within the range of 5·6 to 6·4.

Fisher (R. W.). **Note on resistance to DDT in the codling moth, *Carpocapsa pomonella* (L.), in Ontario.**—*Canad. J. Pl. Sci.* **40** no. 3 pp. 580–582, 1 pl. Ottawa, 1960.

Difficulty was experienced in 1957 in controlling *Cydia* (*Carpocapsa*) *pomonella* (L.) on apple by means of DDT in two experimental orchards in Ontario, and 86 per cent. of the fruits in one of them were damaged in 1958, despite thorough application of six cover sprays. Susceptibility was evaluated in the laboratory from the survival of larvae hatching from eggs laid on waxed paper by females originating from this orchard, which had been sprayed with DDT each year since 1946, and from one that had been sprayed with DDT only once or twice in about that year and not since. The larvae were enclosed in cells fixed to apples that had previously been sprayed with wettable DDT and were kept at 70°F. and 70 per cent. relative humidity. The results indicated that the population from the unsprayed orchard was homogeneous and susceptible to low doses of DDT, whereas the other included individuals of widely varying susceptibility and was at least 16 times as resistant. In a field trial in 1959, in which schedules of seven cover sprays were applied to the sprayed orchard by air-blast equipment at 70 gal. per acre, no fruit was left on trees sprayed with 2 lb. 50 per cent. DDT per 100 gal. at the time of the sixth cover spray, and a schedule of 50 per cent. ryania at 6 lb. gave poor control. A spray of 1¼ lb. 25 per cent. azinphos-methyl (Guthion) per 100 gal. reduced the percentage of damaged fruit to 7·5, but one of 2 lb. 50 per cent. wettable Sevin was less effective (26·6 per cent. damaged fruit), and this is attributed to reinfestation from plots where control was poor, since, in the other orchard where resistance had appeared and which had been regularly sprayed with DDT, seven applications of the Sevin spray at 2 and 1 lb. per 100 gal. and a rate of 400 gal. per acre reduced the percentage of damaged fruits to 7·7 and 0·8, respectively. The addition of 2 lb. 25 per cent. malathion or 1 pint 49 per cent. phosphamidon per 100 gal. to the last five cover sprays of DDT reduced damage to a considerable, but not economically practicable, degree.

Begg (J. A.), Plummer (P. J. G.) & Konst (H.). **Insecticide residues in potatoes after soil treatments for control of wireworms.**—*Canad. J. Pl. Sci.* **40** no. 4 pp. 680–689, 17 refs. Ottawa, 1960.

The following is almost entirely the authors' abstract. Chemical analyses and bioassays with *Drosophila melanogaster* Mg. showed residues of less than 0·1 part aldrin, chlordane, dieldrin and heptachlor per million in the pulp of early potatoes grown in Ontario in a sandy loam soil treated for the control of *Limonius agonus* (Say) [*cf. R.A.E.*, A **47** 449]. The insecticides had been applied at the rate of 5 lb. toxicant per acre 3, 15 or 27 months before the potatoes were harvested. The residues in the potatoes did not cause any gross or histopathological changes in guineapigs or rats.

Wilde (W. H. A.). **Insect transmission of the virus causing little cherry disease.**—*Canad. J. Pl. Sci.* **40** no. 4 pp. 707–712, 21 refs. Ottawa, 1960.

The following is based almost entirely on the author's abstract. The little-cherry virus disease of sweet cherry is common in the Kootenaz Lake area of British Columbia. In experiments, the virus was transmitted under

screenhouse conditions by three of 24 species of Cicadellids tested. *Macrosteles fascifrons* (Stål) transmitted it in seven tests, and *Scaphytopius acutus* (Say) and *Psammotettix lividellus* (Zett.) each transmitted it once. The transmissions were made from diseased sweet-cherry trees of one variety to young indicator trees of two other varieties. Except in one case, intervals of 2–4 years were necessary after inoculation for the unmistakable expression of symptoms in the indicators. *M. fascifrons* was also implicated in 18 successful transmissions to mature sweet-cherry trees grown in the open.

Read (D. C.). **Control of root maggots attacking Cruciferous crops, mainly rutabagas, grown in ridges.**—*Canad. J. Pl. Sci.* **40** no. 4 pp. 721–728, 6 refs. Ottawa, 1960.

The following is based largely on the author's abstract. Experiments in 1958 and 1959 on pre-sowing soil treatment with insecticides, applied in almost all cases in a 5-in. band 1½ in. below the seed in ridges of soil, showed that heptachlor, aldrin and chlordane, each at 5 lb. toxicant per acre, gave 70–90 per cent. reduction in damage caused by *Hylemyia brassicae* (Bch.) to swedes in Prince Edward Island [*cf. R.A.E.*, A **47** 187]. Each gave better control of the second than of the first generation. Experimental Nematocide 18,133 (O,O-diethyl O-2-pyrazinyl phosphorothioate) at 5 and 10 lb. per acre gave complete control throughout the growing season, and plots treated with it gave the highest yield. Phorate (Thimet) at 5 and 10 lb. gave better control than did chlorinated hydrocarbons, and parathion and azinphos-methyl (Guthion) at the same rates gave better control of the first than of the second generation. Wettable fenchlorphos (Korlan) applied with a hand applicator at 6 lb. toxicant per acre gave fair control of the first generation but was ineffective against the second. Ethion, Trithion, Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate) and diazinon, each at 5 and 10 lb., coumaphos (Co-Ral) and trichlorphon (Dylox) at 5 lb., and malathion at 3 and 5 lb. were ineffective. Diazinon was highly phytotoxic, but none of the other insecticides caused any plant injury. In other tests, hepatachlor, parathion, the nematocide and phorate were as effective in protecting cabbage, cauliflower, broccoli and brussels sprouts at 5 lb. per acre for plants grown directly from seed in the field and at 2 lb. per acre, applied by means of a hand applicator three days after planting out, for transplants as they had been in protecting swedes.

Coppel (H. C.), House (H. L.) & Maw (M. G.). **Studies on Dipterous parasites of the spruce budworm, *Choristoneura fumiferana* (Clem.) (Lepidoptera: Tortricidae). VII. *Agria affinis* (Fall.) (Diptera: Sarcophagidae).**—*Canad. J. Zool.* **37** (1959) no. 6 pp. 817–830, 16 figs., 26 refs. Ottawa [1960].

The following is based almost entirely on the authors' abstract of this seventh part of a series on Dipterous parasites of *Choristoneura fumiferana* (Clem.) in British Columbia [*cf. R.A.E.*, A **48** 234, etc.]. *Agria affinis* (Fall.), a holarctic parasite of Lepidoptera, Orthoptera and Hymenoptera, the larval stages of which are described, is one of the commoner of the native Sarcophagid parasites of *C. fumiferana* in British Columbia and in a work already noticed [**38** 100] was listed fourth in importance among Dipterous and seventh among all parasites of this Tortricid. The females deposit first-stage larvae on or near the late larval and pupal stages of the host. The larvae penetrate the host integument and complete their development

inside, dropping to the ground to overwinter in puparia. Adults emerge in the following spring. Mated females had a pre-larviposition period of about 21 days and deposited larvae for up to 45 days. Larval development was completed in 5–8 days, and at about 21°C. [69·8°F.] and 60 per cent. relative humidity the puparia were formed within 24 hours. The adults emerged after 10–14 days if dormancy did not intervene. In the laboratory at Belleville, Ontario, *A. affinis* is propagated continuously (on pork liver), as the stock, which originated in British Columbia, now appears to have no significant pupal diapause. More than 50,000 adults have been released in Manitoba, Ontario, Quebec, New Brunswick and Newfoundland. Parasitism of *C. fumiferana* due to the Sarcophagid in various places in British Columbia in 1944–49 varied from 0·1 to 6·27 per cent., and the parasite was responsible for 2·6 per cent. parasitism of all larvae from Douglas fir [*Pseudotsuga menziesii*], 0·6 per cent. from Engelmann spruce [*Picea engelmanni*] and 0·1 per cent. from alpine fir [*Abies lasiocarpa*]; no larvae were parasitised on juniper [*Juniperus*].

Stark (R. W.). **Population dynamics of the lodgepole needle miner, *Recurvaria starki* Freeman, in Canadian Rocky Mountain parks.**—*Canad. J. Zool.* **37** (1959) no. 6 pp. 917–943, 12 graphs, 58 refs. Ottawa [1960].

The following is based almost entirely on the author's abstract. *Recurvaria starki* Freeman, which defoliated stands of lodgepole pine (*Pinus contorta* var. *latifolia*) in certain national parks of western Canada [*cf. R.A.E.*, A **47** 86] during an outbreak that was first observed in 1942, has been studied intensively there since 1948. Life tables [*cf.* **48** 141] and survival and death-rate curves show clearly that there are five periods in its two-year life-cycle during which extensive mortality may occur, namely, between egg-formation and oviposition, between oviposition and larval establishment, during each of the two larval hibernation periods, and during the spring of adult emergence. Population increase is also undoubtedly affected by conditions during adult life. Population sampling showed that the outbreak has declined since 1948. Defoliation and increment studies indicated that the period of greatest defoliation was from 1940 to 1944 and that the outbreak probably began about 1938. The major cause of the decline was severe winter temperatures, probably during the coldest month [*cf.* **49** 189]. Parasitism was not an important factor, apparently because it was controlled in the same manner as the host by winter temperatures. Other natural control factors are discussed, as well as the possible effects of climatic factors on oviposition and fecundity.

A detailed survey of weather records since 1920 and yearly averages since 1885 suggests that release of the population of *R. starki* was due to a warming trend in the climate of western Canada. This trend began about 1937, reached a peak about 1945, and has declined since that time. The warming trend in northern latitudes has been noted by other authors and is substantiated by weather records. It is further postulated that the climate of the Canadian Rocky Mountains is generally too severe for an outbreak of *R. starki* to be prolonged.

Muma (M. H.). **Chrysopidae associated with *Citrus* in Florida.**—*Florida Ent.* **42** no. 1 pp. 21–29, 18 figs., 9 refs. Gainesville, Fla., 1959.

Chrysopids are of some importance as predators of insects and mites on *Citrus* in Florida. In this paper, the author gives a field key to the adults

and third-instar larvae (so far as known) of the species concerned, which are mainly of the genus *Chrysopa*, followed by a list of them, with information on their larval and adult characters, local and seasonal distribution, feeding habits and, where possible, life-cycles.

Tappan (W. B.). **Mite control in redworm beds.**—*Florida Ent.* **42** no. 1 pp. 31–34, 1 ref. Gainesville, Fla., 1959.

Mites caused serious losses of production in commercial redworm beds in Florida in 1956. Investigations showed that four species were present. The commonest were two species of *Macrocheles*, the importance of which was not known. The losses were caused by *Fuscuropoda agitans* (Banks), which ate the worms' food. The other was *F. marginata* (Koch), which preyed on *F. agitans* and apparently caused some reduction of the latter in untreated beds. In tests on control [*cf. R.A.E.*, A **45** 275], several materials gave good immediate results, but the only one that remained effective for 14 days was parathion, applied in sprays at 50–400 parts per million.

Genung (W. G.). **Biological and ecological observations on** *Mydas maculiventris* **Westwood (Diptera: Mydaidae) as a predator of white grubs.**—*Florida Ent.* **42** no. 1 pp. 35–37, 8 refs. Gainesville, Fla., 1959.

Larvae of *Mydas maculiventris* Westw. are recorded preying on Lamellicorn larvae in plots of grass in Florida.

Genung (W. G.). **Notes on the Syntomid moth** *Lymire edwardsi* **(Grote) and its control as a pest of** *Ficus* **in south Florida.**—*Florida Ent.* **42** no. 1 pp. 39–42, 1 ref. Gainesville, Fla., 1959.

Lymire edwardsi (Grote), all stages of which are described, feeds in the larval stage on the leaves of species of *Ficus* used for ornament and shade in southern Florida [*cf. R.A.E.*, A **18** 115]. The damage was severe in 1958. Observations showed that the pupae were parasitised by *Brachymeria robusta* (Cress.), *B. ovata* (Say) and *Achaetoneura aletiae* (Ril.), the percentage concerned ranging from 0 in mid-June to 89·2 in mid-July; *B. robusta* was the commonest. The eggs were parasitised by *Telenomus* sp., and the larvae were attacked by three Pentatomids, *Euthyrhynchus floridanus* (L.), *Podisus maculiventris* (Say) and *P. mucronatus* Uhl. In a test, good control of the larvae was given by emulsion sprays of 1 lb. toxaphene or 8 oz. DDT per 100 U.S.gal. The larvae migrate to the walls of buildings to pupate, and few were able to cross lawns recently treated with DDT or other insecticides.

Griffiths (J. T.). **Results from the use of zineb in** *Citrus* **groves during the 1957 & 1958 growing seasons.**—*Florida Ent.* **42** no. 2 pp. 85–91, 2 refs. Gainesville, Fla., 1959.

Details are given of experiments in commercial *Citrus* groves in Florida in 1957–58 in which the fungicide zineb, which had previously been reported there to kill the rust mite [*Phyllocoptruta oleivora* (Ashm.)], was tested in sprays against this Eriophyid. The compound was found to be very effective, though damage was not always completely suppressed, and it was longer-lasting than wettable sulphur, so that fewer applications were required.

Since sulphur controls other pests in addition, a combination of the two materials may prove desirable at some seasons [*cf. R.A.E.*, A **49** 116]. Dosages as low as 5 lb. per acre were quite effective in old orange groves.

Genung (W. G.). **Observations on and preliminary experiments with a polyhedrosis virus for control of cabbage looper, *Trichoplusia ni* (Hbn.).** —*Florida Ent.* **42** no. 3 pp. 99–104, 3 figs., 12 refs. Gainesville, Fla., 1959.

Observations in the Everglades area of Florida indicated that a polyhedral virus disease controls *Trichoplusia ni* (Hb.) on cabbage crops in late spring and early summer [*cf. R.A.E.*, A **46** 427]. The symptoms and course of the disease are described, and an account is given of tests in which sprays prepared from viruliferous material considerably increased natural mortality.

Robertson (O. T.), Stedronsky (V. L.) & Currie (D. H.). **Kill of pink bollworms in the cotton gin and the oil mill.**—*Prod. Res. Rep. U.S. Dep. Agric.* no. 26, [1+] 22 pp., 3 figs., 1 ref. Washington, D.C., 1959.

The following is substantially the authors' summary. Investigations were carried out in the United States in 1953–56 to determine the mortality of resting larvae of *Pectinophora gossypiella* (Saund.) resulting from cotton-gin and oil-mill processes and, if possible, to find ways of increasing it. Associated tests dealt with the kill caused by delinting and hot-water treatment of cottonseed intended for sowing. Tests were made at a ginning research laboratory, at many commercial gins, at a modern oil mill, and at three seed-delinting plants.

In the ginning laboratory, the results of tests on infested snapped cotton indicated that ginning with the simplest apparatus had killed 84 per cent. of the larvae in seed taken at the gin stand, and that adding machinery until the installation became elaborate increased the kill to more than 99 per cent. The results with infested hand-picked cotton showed a similar trend. Further kill was caused by the seed-blow system. The large numbers of living larvae found in the gin trash confirmed the need for treating this. In tests with commercially ginned seed, similar results were obtained as to mortality during ginning.

Tests were made with fans of the kinds commonly used for treating trash as it occurs in the ginning operation and for moving motes and linters to the press at oil mills. Such fans, whether their housings were unlined or had rubber linings, were found to kill all the larvae in gin trash and in linters, motes and hulls if designed and operated according to specifications developed as a result of the research reported. These specifications have since been approved as quarantine requirements in the United States.

Investigation of treatments commonly applied to cottonseed intended for sowing showed that all the larvae in infested seed were killed by the standard acid or mechanical-flame delinting process or by the hot-water treatment commonly applied to hasten germination, which is immersion in water at temperatures between 160 and 180°F. for 1–2 minutes. As a result of this finding, seed that is delinted at approved acid or mechanical-flame delinting plants or that receives the approved hot-water treatment for hastening germination may now be certified for movement out of the quarantine area [*cf. R.A.E.*, A **37** 376] without further treatment.

Owing to the kill resulting from normal ginning operations and the further kill in oil-mill processing or treatment of seed for sowing, it is concluded that survival in cottonseed has little, if any, importance when the seed is used within the generally infested area in the United States. This finding has led to the abolition in Texas and New Mexico of regulations requiring heat treatment of cottonseed at gins.

Paschke (J. D.). **Production of the agamic alate form of the spotted alfalfa aphid, *Therioaphis maculata* (Buckton) (Homoptera: Aphidae).** —*Univ. Calif. Publ. Ent.* **16** no. 4 pp. [3+] 125–175, 3 pls., 8 figs., 40 refs. Berkeley, Cal., 1959.

The following is based on the author's summary and conclusions. An account is given of investigations in California on the factors influencing the production of alates in *Therioaphis maculata* (Buckt.), an important pest of lucerne. Laboratory and field evidence indicated that the primary factor was crowding, and samples from three widely separated areas showed that the percentage of fourth-instar nymphal alates was correlated with the population density of the previous week. In collections from northern California, alates were present and predominant throughout the year. The effect of crowding was exercised on the first-instar nymphs. Production of alates was also stimulated by rearing on plants deficient in potassium or phosphorus, but not by starvation or feeding on old leaves. There was no influence of photoperiod. The progeny of alates were mostly apterous when reared under conditions of low density and alates when reared at high density.

Schlinger (E. I.) & Hall (J. C.). **The biology, behavior, and morphology of *Praon palitans* Muesebeck, an internal parasite of the spotted alfalfa aphid, *Therioaphis maculata* (Buckton) (Hymenoptera: Braconidae, Aphidiinae).**—*Ann. ent. Soc. Amer.* **53** no. 2 pp. 144–160, 9 figs., 20 refs. College Park, Md., 1960.

Praon palitans Mues. is one of the introduced parasites released in the United States against *Therioaphis maculata* (Buckt.) on lucerne [*cf. R.A.E.*, A **48** 226–228], and the following is substantially the authors' abstract of this account of investigations on its morphology and bionomics.

The adults, egg and larva of the Braconid are described, and the adult male, male genitalia, ovaries (and associated structures), egg, first-, second-, and third-instar larvae and head structures are illustrated.

Unmated females produce only males; mated females produce progeny in a sex ratio of 1:1, but multi-mated males supply so little sperm at each mating that the sex ratio may rise as high as 58:1 in favour of males. The parasite oviposits in aphids of any stage, but apparently prefers the third and fourth instars. The life-span of adult females at constant temperatures, with honey for food, was 10 days at 28°F., 48 days at 50°F., and 1 day at 80–100°F. Life was greatly reduced when honey was withheld. Superparasitism occurs only rarely, since the female is apparently able to detect a punctured host. Discrimination of a parasitised host is apparently due to some chemical response by the antennae rather than to any tarsal or ovipositional response. The egg in the host increases volumetrically by 634 times during its 69–71 hours of development. The first larval instar lasts about 25–27 hours, with the larva feeding almost exclusively on the cells of the trophamnion. The second instar lasts about 22–24 hours, with the larva feeding as before. The third instar in its internal phase lasts

about 18–20 hours, and during this period all aphid contents are consumed, the parasitised aphid living until a few minutes before the parasite larva emerges. The third instar in its external phase lasts about 24–26 hours, and during this period the characteristic cocoon is spun underneath the dead aphid host. The five steps of cocoon formation are described, together with comments on the four forms of diapause and non-diapause cocoons. The pupal period lasts about 94–98 hours, and some 15 or more meconial pellets are passed about 12–19 hours before pupation. A complete life-cycle at 70°F. requires nearly 12 days. There are probably 15 generations a year in the field.

Aphid defences against parasitism include the production of a copious supply of honeydew, which often traps or hinders the parasite, and the habit of jumping out of reach of the parasite. The parasite partly overcomes the latter by placing its front legs on top of the aphid during oviposition. A facultative diapause exists and lasts for about 140 days in the field during the winter months; the effect of this on subsequent parasitism is noted; various factors that may limit the effectiveness of *P. palitans* are discussed, and its present distribution, hosts and parasites are noted.

Maxwell (R. C.) & Harwood (R. F.). **Increased reproduction of pea aphids on broad beans treated with 2,4-D.**—*Ann. ent. Soc. Amer.* **53** no. 2 pp. 199–205, 2 figs., 35 refs. College Park, Md., 1960.

The following is virtually the authors' abstract. Sufficient concentrations of 2,4-D [2,4-dichlorophenoxyacetic acid] as the dimethylamine salt to cause only slight and transitory symptoms on broad beans (*Vicia faba*) markedly increased the reproductive rate of *Macrosiphum pisum* (Harris) feeding on treated plants in the laboratory. The life-span of the adult aphids, and the growth rate of nymphs of *Melanoplus bivittatus* (Say), were apparently unaffected. The most notable chemical changes in the growing terminals, where aphid development is greatest, occurred in the free amino nitrogen fraction. Increased free amounts of alanine, aspartic acid, serine and glutathione were especially evident.

Beck (S. D.). **The European corn borer, *Pyrausta nubilalis* (Hubn.), and its principal host plant. VII. Larval feeding behavior and host plant resistance.**—*Ann. ent. Soc. Amer.* **53** no. 2 pp. 206–212, 4 figs., 29 refs. College Park, Md., 1960.

The following is virtually the author's summary of this part of a series [*cf. R.A.E.*, A **47** 12, etc.]. Resistance of maize to *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) is manifested as increased larval mortality, inhibition of larval growth and reduction in larval feeding. Leaf lesions caused by larval feeding are smaller and fewer per infesting larva on resistant lines than on susceptible lines of maize. Resistance Factor A (6-methoxybenzoxazolinone) [*cf.* **46** 458] exerted a deleterious effect on feeding of first-instar larvae, acting as a feeding deterrent and not as a simple repellent. Reduction in duration of larval feeding was proportional to RFA concentration, but inhibition of larval growth by RFA could not be accounted for on this basis. No significant correlation between feeding suppression and growth inhibition was found in experiments using a series of 15 benzoxazolinone and benzothiazole analogues. Lowering of RFA inhibitory action by high concentration of dietary sugar was not caused by a masking of RFA effects on feeding behaviour. The available evidence indicates that RFA inhibited larval

growth by metabolic action, not via behavioural effects. Under field conditions, larval mortality on resistant plants was higher than that observed in the laboratory among larvae on purified diets containing comparable concentrations of RFA. The reduced feeding and inhibited growth induced by RFA probably tend to increase larval mortality by prolonging the exposure of the weakened larvae to adverse environmental conditions.

Baron (R. L.) & Guthrie (F. E.). **A quantitative and qualitative study of sugars found in tobacco as affected by the green peach aphid,** *Myzus persicae*, **and its honeydew.**—*Ann. ent. Soc. Amer.* **53** no. 2 pp. 220–228, 3 figs., 32 refs. College Park, Md., 1960.

The following is virtually the authors' abstract. In experiments in North Carolina, infestation by *Myzus persicae* (Sulz.) quantitatively reduced the sugar content of tobacco plants. Although the plants compensated somewhat for the loss due to aphid feeding, a decrease in sugar content became evident when aphid infestation was at a high level. Analysis of the honeydew showed the presence of three, and possible four, oligosaccharides, which were tentatively identified as glucosucrose, maltosucrose and maltotriosucrose. The fact that these sugars were not found in the plant extract indicated that they were metabolic products. Observations on the relative amounts of the sugars present in honeydew and in the plant extract indicated that the aphids removed glucose from the plant sap and converted it to non-reducing oligosaccharides, through some undetermined metabolism process. Amino acid analysis, though not complete, indicated the presence of two products in the honeydew that were not present in the plant extract.

McEwen (F. L.) & Hervey (G. E. R.). **Mass-rearing the cabbage looper,** *Trichoplusia ni*, **with notes on its biology in the laboratory.**—*Ann. ent. Soc. Amer.* **53** no. 2 pp. 229–234, 2 figs., 6 refs. College Park, Md., 1960.

The following is virtually the authors' summary. By the method described, large numbers of *Trichoplusia ni* (Hb.) can be easily reared on broccoli foliage in the laboratory provided that the temperature is maintained at about 75°F. and strict sanitation is employed to prevent bacterial and viral infection. Under these conditions, the insects will pass through 13 generations each year. Larval weight approximately doubles each day, and each larva consumes about three times its weight in food daily. Head capsule width was determined for each larval instar, and the reproductive capacity was studied for each of three moth colonies.

Walton (B. C. J.). **The life cycle of the hackberry gall-former,** *Pachypsylla celtidis-gemma* **(Homoptera: Psyllidae).**—*Ann. ent. Soc. Amer.* **53** no. 2 pp. 265–277, 11 figs., 17 refs. College Park, Md., 1960.

In the vicinity of New York City, hackberry (*Celtis occidentalis*) is commonly infested by *Pachypsylla celtidis-gemma* Ril., which destroys the leaf-buds by forming galls on the young twigs. The bionomics of the Psyllid [*cf. R.A.E.*, A **9** 198] were investigated, and the following is based on the author's summary of this account of the results. The adults of the Psyllid are present for only a short period in the later part of June. Eggs are

laid on the young leaves, a single female laying more than 100. The first-instar nymphs enter the buds to initiate gall formation, and commonly several nymphs, each in its own chamber, are found within a gall. The first four instars require 3½ to 4 weeks each, the nymphal moults occurring inside the gall. Fifth-instar nymphs overwinter in the galls, and the final moult takes place after emergence from them in mid-June; the average duration of this instar is 34 weeks. A differentiated region of granular sclerenchyma tissue in the outer gall wall serves as an escape hatch for the fifth instar. Infested buds are destroyed by the Psyllid. Heavily infested trees appear unsightly, and young trees subjected to repeated annual attacks may not survive.

Rodriguez (J. G.), Chen (H. H.) & Smith jr. (W. T.). **Effects of soil insecticides on apple trees and resulting effect on mite nutrition.**—*J. econ. Ent.* **53** no. 4 pp. 487–490, 4 graphs, 8 refs. Menasha, Wis., 1960.

The following is based largely on the authors' abstract. In tests in 1956–57, apple trees were planted each year in cans of soil that had been treated with DDT, dieldrin or BHC at different rates, fertiliser being added in 1956 only, and females of *Panonychus ulmi* (Koch) and *Tetranychus telarius* (L.) were reared on leaves detached from the trees. The resulting progeny were counted, the reactions of the trees were measured, and the foliage was analysed for its content of total nitrogen, phosphorus and potassium; the results were analysed statistically.

Root weight was reduced by 100–2,500 lb. DDT or 50–500 lb. dieldrin per acre in 1956 and increased by 100 lb. DDT in 1957, and twig growth was reduced by 100–2,500 lb. DDT and 500 lb. dieldrin in 1956 and by 200 lb. BHC in 1957, but only the effect of dieldrin on the roots was significant. Changes in chemical composition were less striking in the slower growing, woody apple trees than they had been in annual crops [*cf. R.A.E.*, A **46** 432]. In 1956, 100 lb. DDT increased absorbed phosphorus from 0·28 to 0·32 per cent. (not significant) and reduced populations of both mite species, whereas 1,000 lb. DDT did not affect phosphorus content and increased mite numbers, populations from the two treatments being significantly different. Dieldrin increased populations of *T. telarius* at 50 lb. and decreased those of both species at 500 lb. per acre. In 1957, 100–4,000 lb. DDT significantly increased the nitrogen content and increased mite populations; absorbed phosphorus generally fell below 0·2 per cent. and was positively correlated with populations of *T. telarius*. BHC reduced populations of *T. telarius* at 20–200 lb. per acre.

Rodriguez (J. G.), Maynard (D. E.) & Smith jr. (W. T.). **Effects of soil insecticides and absorbents on plant sugars and resulting effect on mite nutrition.**—*J. econ. Ent.* **53** no. 4 pp. 491–495, 4 graphs, 9 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. The effects of adding DDT and absorbent materials (peat moss, calcium hydroxide or various activated carbons) to the soil on the composition of Black Valentine beans and soy beans and on populations of *Tetranychus telarius* (L.) developing on them were investigated in the greenhouse. The treatments comprised DDT at 800 and 1,600 lb. per acre, alone and with absorbent materials at six rates. Mite development was measured by counting the progeny that developed in eight days from five young adult females on a detached leaf

disk, the dry weight of the foliage was recorded and the foliage was analysed for total and reducing sugars, and for total nitrogen, phosphorus and potassium, and the results were analysed statistically.

In Black Valentine beans, both dosages of DDT increased the contents of total and reducing sugars and of nitrogen, increased the mite populations and reduced the amounts of phosphorus and potassium and the dry weight of the foliage. Some of the activated carbons reduced the chemical components of the plants and the mite populations to normal levels, indicating that mite numbers are correlated positively with reducing sugar and nitrogen, and in some cases with total sugar, and negatively with the phosphorus and potassium contents and the dry weight of the foliage. Peat moss and calcium hydroxide did not have this effect.

Soy beans were less sensitive to DDT; the percentages of reducing and total sugars increased much less, and lower concentrations of absorbent were needed to reduce them to the original levels. The mite population was increased by DDT and reduced to normal levels by the addition of activated carbon.

Smith (C. T.) & others. **Residues of malathion on alfalfa and in milk and meat.**—*J. econ. Ent.* **53** no. 4 pp. 495–496, 8 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract of this account of investigations carried out in 1957. When malathion was applied at 1 lb. per acre to lucerne 11·4 in. tall in a spray on 22nd August 1957, the residue on the plants decreased from an average of 69 parts per million immediately after treatment to 0·25 p.p.m. six days later. Dairy cows fed with unsprayed lucerne in the morning and with lucerne bearing a residue of 8 p.p.m. malathion at milking time for three weeks did not excrete the insecticide in their milk or contain detectable amounts in the blood, brain, liver, kidney or other tissues when slaughtered at the end of this period.

Hilchey (J. D.) & Cooper (R. D.). **Dosimetry for studies on the radiobiology of *Tribolium castaneum* using the Van de Graaff electron accelerator.**—*J. econ. Ent.* **53** no. 4 pp. 496–500, 1 graph, 4 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. In carrying out investigations on the feeding activity of adults of *Tribolium castaneum* (Hbst.) that had been irradiated with high-energy electrons, it was necessary to determine the amount of radiation absorbed by the insects when exposed to the beam of a Van de Graaff electron accelerator [*cf. R.A.E.*, A **44** 272]. The absorbed dose, in rads, is calculated from the power output of the accelerator, the mass of the insect, the length of time for which it is in the beam, the fraction of the scanned area that it occupies and the fraction of the energy of the incident electrons that is lost in the insect. The expression is developed in detail on the basis of the ideal case, but possible departures from this in practice are discussed. The physical parameters of the insect that pertain to the calculation of dose are reported.

Brown (H. E.). **Insecticidal control of the Hessian fly.**—*J. econ. Ent.* **53** no. 4 pp. 501–503, 4 refs. Menasha, Wis., 1960.

In further tests in Missouri in 1957–59, in which systemic insecticides for the control of *Mayetiola (Phytophaga) destructor* (Say) on wheat [*cf. R.A.E.*,

A **45** 443] were applied with fertiliser from a standard grain-drill during sowing, about a month before the local fly-free date, 0·5–4 lb. phorate (Thimet) and 1–2 lb. Am.Cyanamid 12008 (O,O-diethyl S-isopropylthiomethyl phosphorodithioate) or Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate) per acre gave good control; 2–4 lb. phorate sometimes caused considerable plant injury, but all other treatments increased the yield, 1 lb. phorate and 1 lb. Di-Syston doing so significantly. Phorate at 1 lb. gave complete protection for a long time and was more effective than any other treatment. Coating the seeds with phorate at 0·5 lb. per acre gave good control, but damaged the plants and did not increase yield.

Bess (H. A.) & Ota (A. K.). **Fumigation of buildings to control the drywood termite** *Cryptotermes brevis*.—*J. econ. Ent.* **53** no. 4 pp. 503–510, 5 figs., 6 refs. Menasha, Wis., 1960.

Cryptotermes brevis (Wlk.) causes considerable damage to buildings and furniture in Hawaii, and investigations on its control in buildings by fumigation were begun in 1957; the buildings to be treated were first covered in nylon or polyethylene tarpaulins firmly secured against the ground. The following is based on the authors' abstract. Fumigation with methyl bromide at 2·5 lb. per 1,000 cu. ft. for 15–19 hours apparently eliminated all natural infestations of the termite in 23 of 24 buildings, but mortality among examples caged in wooden blocks in them was less uniform, reaching 0–10, 11–50, 51–90, 91–99 and 100 per cent. in 2, 3, 3, 4 and 6, respectively, of 18 buildings. Treatment with 2 lb. sulphuryl fluoride per 1,000 cu. ft. proved effective in buildings and killed all the termites in similar blocks in 1·5 hours, but fumigation with 2–3 lb. ethylene dibromide per 1,000 cu. ft. for 24 hours caused no measurable mortality in the blocks and did not eliminate natural infestations in two of five buildings. It was apparent that sulphuryl fluoride, which was used in eight buildings, was much superior to methyl bromide, and ethylene dibromide much inferior; its use should make it possible to reduce exposure time considerably, which would be of great advantage.

Buchanan (W. D.). **Biology of the oak timberworm,** *Arrhenodes minutus*.—*J. econ. Ent.* **53** no. 4 pp. 510–513, 5 figs. Menasha, Wis., 1960.

The following is based mainly on the author's abstract. In Missouri, *Arrhenodes minutus* (Dru.) makes ' pin holes ' that degrade or even destroy the value of potential products from many oak trees, and field observations on its bionomics on black oak [*Quercus velutina*] and scarlet oak [*Q. coccinea*] were made in 1954–58. The eggs of the Brenthid are laid in wounds that expose the bare wood on living trees; the larvae make their galleries across the grain of the wood, keeping them clean by expelling borings and other débris through hair-sized holes made by the parent females, and pupate near the exit from the gallery. The life-cycle lasted two years for three individuals, three years for 122 and four for one. No evidence of attack was found on trees that had not been wounded, but attacks were made on about 50, 78, 60 and 14 per cent. of those wounded with an axe in March, May, June and late July, respectively. In general, wounds less than three weeks old seemed to be the most attractive for oviposition, but eggs were occasionally laid in wounds that were two years old. They were not laid in wounded trees that were less than 5·5 in. in diameter at breast height, whatever the age of the wound.

McEwen (F. L.) & Hervey (G. E. R.). **The effect of *Lygus* bug control on the yield of lima beans.**—*J. econ. Ent.* **53** no. 4 pp. 513–516, 1 fig., 5 refs. Menasha, Wis., 1960.

Field tests in 1956–59 on the effect of attack by *Lygus lineolaris* (P. de B.) on two varieties of lima bean in western New York showed that large populations of nymphs might cause 50–70 per cent. loss in yield, owing primarily to the shedding of blossoms and newly set pods by infested plants early in the season. Four spray applications of 0·5–1 lb. parathion or 1 lb. Trithion or Sevin per acre in July–August caused significant increases in yield from beans sown in May–June, and it is recommended that applications should be begun as soon as the first flower buds form and be repeated until an adequate set of pods has been obtained; 2–3 applications may be adequate. It was also found that plants that were protected from the nymphs by insecticide treatment or by screening set more pods early in the season and reached maturity earlier than did unprotected plants.

Chiang (H. C.), Holdaway (F. G.), Brindley (T. A.) & Neiswander (C. R.). **European corn borer populations in relation to the estimation of crop loss.**—*J. econ. Ent* **53** no. 4 pp. 517–522, 18 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. Investigations were made in Iowa, Minnesota and Ohio in 1953, 1954 and 1955 on the relations between midsummer and autumn populations of *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) and their effect on the yield of maize. These relations are affected by the proportion of the first generation that pupate in summer, the selection of fields and plants for oviposition by the resulting adults and the survival of the different developmental stages of the second generation. A summer population may give rise to an autumn population that is many times larger or much smaller, and autumn populations of the same size may consist of very different proportions of individuals of the first and second generations.

The quantitative relations between midsummer and autumn populations are further complicated by differential egg deposition due to plant growth; the plants that are more attractive for oviposition during the first generation will be less so during the second. They are also affected by the lack of attractiveness for egg deposition of plants that are heavily infested by the first generation and the decreased survival of larvae of the second generation on plants heavily injured by the first, which possibly results from a lack of suitable feeding sites.

The positive relation between population and yield sometimes found is explicable from this analysis of population dynamics, and it is concluded that although the autumn population may be a reliable basis for estimating the numbers of larvae entering hibernation, the summer population is probably a better index for estimating the loss in yield of maize due to infestation in the current year.

Ellertson (F. E.). **Evaluation of chemicals for control of a spider mite complex on cherry and peach.**—*J. econ. Ent.* **53** no. 4 pp. 522–526, 2 refs. Menasha, Wis., 1960.

The results are given of tests of chemicals for the control of *Bryobia rubrioculus* (Scheuten) (*arborea* Morgan & Anderson) on sour cherry and *Tetranychus telarius* (L.) and *T. mcdanieli* McG. on peach and sour cherry

in Oregon in 1955–59. When applied in wettable-powder sprays, Trithion and Kelthane gave good control of all three species, Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite) controlled *T. telarius* and *T. mcdanieli* and malathion controlled *B. rubrioculus*, but chlorfenson (ovex) was ineffective. In sprays against the two web-spinning species of *Tetranychus*, ethion, diazinon and Tedion wettable powders and a Trithion emulsion concentrate proved effective, wettable parathion afforded some control for a short time, azinphos-methyl (Guthion) gave inconclusive results, and wettable Sulphenone (p-chlorophenyl phenyl sulphone) and chlorbenside were ineffective. In dusts, 3 per cent. Tedion gave satisfactory control of all three species, but it must be applied against small populations for the best results; 3 per cent. Kelthane controlled only *Bryobia*, and 3 per cent. Aramite, 2 per cent. Tedion and 73–84 per cent. sulphur were unsatisfactory.

Gould (G. E.). **Problems in the control of mint insects.**—*J. econ. Ent.* **53** no. 4 pp. 526–531, 1 fig., 1 ref. Menasha, Wis., 1960.

The following is substantially the author's abstract. Of the 54 species of insects and related pests found on peppermint [*Mentha piperita*] and spearmint [*M. spicata*] in Indiana, only cutworms and the mint looper, *Rachiplusia ou* (Gn.), have caused much damage in the past ten years. *Longitarsus waterhousei* Kutsch. [*cf. R.A.E.*, A **24** 459] has not been abundant since the adoption of a two-year crop rotation. Several species of Hemiptera are present every year, but losses due to them are slight.

Cutworms of several species were present in mint fields both early in the season and near harvest; chlordane, aldrin, dieldrin and heptachlor gave good control in sprays applied in late April and early May as the first new growth was appearing, and cutworms present in July and August were controlled by a single application after the crop was cut. *R. ou* was found to have two generations a year, with the peaks of larval abundance in late June and mid-August; dieldrin, heptachlor and DDT were the best of numerous insecticides tested against them, two spray applications, ten days apart in late June, giving excellent control. Malathion was found to be of value in sprays against *Tetranychus telarius* (L.) and to have some effect against the Hemiptera.

Of the materials used in the sprays, only malathion has had a tolerance established. Apparent residues found in mint oil from plots treated with heptachlor and dieldrin were quite variable in different years and were sometimes as high as 2·7 and 4·7 parts per million, respectively. In view of the possible unfavourable effects of insecticides on the oil, samples from treated plots were evaluated for flavour, and DDT, dieldrin, chlordane, heptachlor, toxaphene, Strobane, malathion, parathion, EPN-300 and Chlorthion were approved for use, whereas aldrin and lindane [γ BHC] were considered questionable and BHC objectionable.

Stafford (E. M.), Jensen (F. L.) & Kido (H.). **Control of the grape leaf folder in California.**—*J. econ. Ent.* **53** no. 4 pp. 531–534, 5 refs. Menasha, Wis., 1960.

Desmia funeralis (Hb.) has increased in importance on vines in the San Joaquin Valley of California since 1954; it has three complete generations and a partial fourth in the year. In field tests in 1958–59, spraying with

about 1 lb. Sevin, 0·5 lb. endrin or 11·5 lb. lead arsenate per acre or with a preparation of the spores of *Bacillus thuringiensis* controlled larvae of the first generation of the Pyralid, the last treatment being the least persistent, and dusting with about 1 lb. actual Sevin or 0·4 lb. endrin or parathion per acre was effective against those of the second or third generations, which were not controlled by a dust of *B. thuringiensis*. Among several new materials tested in dusts against the third generation, dimethoate and Bayer 22408 (O,O-diethyl O-naphthalimido phosphorothioate) were very promising and Kepone [2,3,3a,4,5,6,7,7a,8,8-decachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene-1-one] and Methyl-Trithion (O,O-dimethyl S-p-chlorophenylthiomethyl phosphorodithioate) unsatisfactory. Incidental observations indicated that a Sevin dust and a malathion spray were more effective than endrin or Sevin sprays against *Erythroneura elegantula* Osborn.

Bass (M. H.) & Rawson (J. W.). **Some effects of age, preimaginal habitat, and adult food on susceptibility of boll weevil to certain insecticides.**— *J. econ. Ent.* **53** no. 4 pp. 534–536, 3 graphs, 9 refs. Menasha, Wis., 1960.

In tests in Alabama in 1958 on the effects of age, pre-imaginal habitat and adult food on the susceptibility of *Anthonomus grandis* Boh. to insecticides [*cf. R.A.E.*, A **40** 334], infested cotton squares and bolls were collected in an area not treated with insecticides, and the emerging adults were treated topically with acetone solutions of toxicants after two or nine days of feeding on blooms, squares or bolls. Mortality counts made 72 hours after treatment showed that all three factors significantly influenced susceptibility to toxaphene and BHC but had little effect on susceptibility to azinphos-methyl (Guthion), and that adult food had most and pre-imaginal habitat least effect on susceptibility to each insecticide. On the basis of the LD50's older adults were less susceptible than younger ones, and those reared from bolls less susceptible than those from squares, to BHC and toxaphene, and adults fed on bolls and blooms were less and more susceptible, respectively, than those fed on squares; the LD50's of the two compounds were 48 and 61 times as great, respectively, for the most resistant individuals (9-day-old adults reared from and fed on bolls) as for the most susceptible (2-day-old adults reared from squares and fed on blooms).

Chapman (H. C.). **Stored-grain insects and their control in New Jersey.**— *J. econ. Ent.* **53** no. 4 pp. 536–539. Menasha, Wis., 1960.

The following is based on the author's abstract. In investigations in 1955–58, 53 species of insects, including 36 species of Coleoptera and five of Lepidoptera, were found in and round grain stores in New Jersey, and insecticides were tested for their effectiveness in protecting stored grain against them. Treatment of 28 bins of wheat before storage at harvest in 1956 with pyrethrins (synergised with piperonyl butoxide) at 1–2 parts per million in emulsion form or 1·5 p.p.m. in a dust or with malathion at 25 p.p.m. in emulsion or 5 p.p.m. in dust, the bins having been disinfected previously, showed that all treatments but pyrethrins emulsion were fairly effective. In 1957, when 21 bins were treated at harvest with pyrethrins at 1·5 and 2 p.p.m. in emulsion or 1·5 p.p.m. in a dust, or with 5 p.p.m. malathion in a dust, and seven others were fumigated six weeks later with

3–4 U.S. gal. of a mixture of ethylene dibromide, ethylene dichloride, carbon bisulphide and carbon tetrachloride (3·5 : 10 : 10 : 76·5) per 1,000 bushels wheat, all treatments proved effective, fumigation, the malathion dust and the higher dosage of pyrethrins emulsion being the best. Of the insects found, *Ahasverus advena* (Waltl) and *Typhaca stercorea* (L.) were abundant in 1956, when the grain had an initial average moisture content of 14 per cent., but not in 1957, when it was drier. *Oryzaephilus surinamensis* (L.) and *Cryptolestes* (*Laemophloeus*) *ferrugineus* (Steph.) (especially the former) were abundant in both years. *Sitotroga cerealella* (Ol.) was observed infesting wheat, maize, rye and barley in the field. The fumigant mixture, applied according to the manufacturer's recommendations, was also very effective in reducing heavy insect infestations in ten bins of wheat in the autumn of 1956.

Brazzel (J. R.) & Lindquist (D. A.). **The effectiveness of chlorinated hydrocarbon insecticide mixtures for control of resistant and susceptible boll weevils.**—*J. econ. Ent.* **53** no. 4 pp. 551–554, 5 graphs, 10 refs. Menasha, Wis., 1960.

Two strains of *Anthonomus grandis* Boh., reared in the laboratory in Texas from adults collected in Mexico in 1957, a resistant one, selected with endrin for 14 generations, and a susceptible one, not subjected to insecticides, were treated in 1958–59 with toxaphene and DDT, applied topically, either alone or in mixtures, to adults. The following is based on the authors' summary of the results. The compounds showed additive effects against the susceptible strain and synergistic ones against the resistant strain [*cf. R.A.E.*, A **48** 377], a 4 : 1 mixture of toxaphene and DDT being the most effective tested, but a dosage of 5–15 μg. toxaphene per weevil was necessary for 50 per cent. mortality of resistant forms, regardless of the amount of DDT combined with it. No evidence of synergism was found in mixtures of toxaphene with methoxy-DDT (methoxychlor) or DDE. Strobane with DDT was slightly less effective than toxaphene with DDT, but the synergistic effect against resistant weevils was evident. No evidence of seasonal tolerance to a 2 : 1 mixture of toxaphene and DDT was found in adults collected in the field in Texas or reared in the laboratory.

Dickason (E. A.). **Mortality factors for the vetch bruchid,** *Bruchus brachialis*.—*J. econ. Ent.* **53** no. 4 pp. 555–558, 1 graph, 4 refs. Menasha, Wis., 1960.

The following is based on the author's abstract. Observations in Oregon in 1957–58 on *Bruchus brachialis* Fhs., an important pest of hairy vetch (*Vicia villosa*), showed that 29·7, 8·5, 4 and 1·7 per cent., respectively, of the initial population failed to survive because the eggs were lost from the pods, the embryos died, the eggs were sterile or non-viable or the adult females fed on them. There was 21·7 per cent. mortality of larvae due to failure to enter a seed and 23·5 per cent. mortality of those within the seeds and very little difference in success between larvae that entered through the hilum and those that entered at the side of the seed. The pupal stage showed no mortality, and there was less than 1 per cent. mortality owing to failure of prepupae to pupate or of adults to escape from the seed. The total mortality during development was 89·32 per cent.

Weigel (C. A.) & Gilpin (G.). **Yield and quality of mushrooms from beds treated with lindane.**—*J. econ. Ent.* **53** no. 4 pp. 558–560, 4 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. Tests were made of the effect on mushrooms of lindane [almost pure γ BHC] applied in a water suspension to the bearing beds for the control of mushroom flies, chiefly *Sciara* (*Bradysia*) *fenestralis* Zett. and *Megaselia agarici* (Lint.). Dosages of 0·5 lb. or less per acre did not affect the yield, but 1 lb. or more tended to depress it. Neither dosage left appreciable residues on mushrooms harvested five days after application. Only slight occasional off-flavours were found in canned mushroom pieces or mushroom soups made from mushrooms treated with 0·25, 0·5 or 1 lb. γ BHC per acre seven days or more before harvest, but those made from mushrooms harvested three days after treatment had a musty flavour.

Robinson (R. J.) & others. **Chloroplast number in leaves of normal wheat plants and those infested with Hessian fly or treated with maleic hydrazide.**—*J. econ. Ent.* **53** no. 4 pp. 560–562, 11 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. Counts of chloroplasts in the leaves of normal wheat plants and of plants infested with *Mayetiola* (*Phytophaga*) *destructor* (Say) or treated with maleic hydrazide showed that chloroplast numbers decreased in the outer leaves and increased in the inner ones of those treated with the hydrazide and increased in both the inner and outer leaves of the infested plants. It appeared that the dark green colour of the inner leaves of infested wheat was due to increased chloroplast numbers, and that of the outer leaves of plants treated with the hydrazide to a greater concentration of chlorophyll per chloroplast.

Whitney (W. K.) & Jantz (O. K.). **A fumigant vaporizer unit for use in laboratory experiments.**—*J. econ. Ent.* **53** no. 4 pp. 562–564, 3 figs. Menasha, Wis., 1960.

The authors describe and illustrate an apparatus in which small quantities of fumigants, mixed in known proportions, can be vaporised by heat for use in laboratory tests.

Genung (W. G.). **The bean leaf skeletonizer, *Autoplusia egena*, and its control on bush snap beans in the Everglades.**—*J. econ. Ent.* **53** no. 4 pp. 566–569, 3 graphs, 10 refs. Menasha, Wis., 1960.

Rather serious spring damage to bush snap beans in Florida in 1957, 1958 and 1959 was found to be due almost entirely to feeding on the leaves, and to some extent on the developing pods, by the larvae of *Autoplusia egena* (Gn.) [*cf. R.A.E.*, A **34** 30]. The egg, larval and pupal stages lasted about 5, 16–20 and 9–12 days, respectively, in May–June, and there are probably 2–3 generations a year. *Apanteles autographae* Mues., *Meteorus autographae* Mues. and *Litomastix* (*Copidosoma*) *truncatella* (Dalm.) parasitised the larvae and *Podisus mucronatus* Uhl., *P. maculiventris* (Say) and various birds preyed on them in May and June, and a fungus disease killed some. In sprays applied at 100 U.S. gal. per acre, all the insecticides tested reduced

leaf injury, and 1–2 lb. toxaphene, 1 lb. Kepone [2,3,3a,4,5,6,7,7a,8,8-decachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene-1-one], 0·5 lb. dieldrin or mevinphos (Phosdrin) and 0·25–0·5 lb. Thiodan in emulsion concentrates, 0·5 lb. wettable ethyl-DDD (Perthane), 0·5 lb. SD-4402 (1,3,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanophthalan), 0·375 lb. azinphos-methyl (Guthion) and 500 g. spores of *Bacillus thuringiensis* were the best.

Peterson (L. K.). **Effects of low temperature on the survival of the alfalfa weevil from Alberta and Utah.**—*J. econ. Ent.* **53** no. 4 pp. 570–572, 15 refs. Menasha, Wis., 1960.

The following is substantially the author's abstract. Adults of *Hypera variabilis* (Hbst.) (*postica* (Gylh.)) were collected in Alberta and Utah in the spring of 1957, and their progeny were reared for one generation on lucerne under identical conditions in the laboratory and compared in the adult stage for mortality at low temperatures. The two groups did not differ in their undercooling points, which averaged about −18°C. [−0·4°F.], and showed no difference in mortality after exposure to −10°C. [14°F.] for 72 days, but the strain from Utah became active much sooner than the Alberta strain when transferred to 10°C. [50°F.] after 11 days at −10°C.

Adults from Alberta and Utah were compared for mortality in the field during the winter of 1957–58 in southern Alberta; they were allowed to select their own habitat in one experiment and restricted to four positions in another. There was no significant difference in mortality between the two groups in either experiment, and it is concluded that the establishment of *H. variabilis* in more northerly regions [*cf. R.A.E.*, A **48** 527] did not result from the development of increased cold resistance, but was possibly due to selection of individuals with slower responses to rising temperature.

Peters (D. C.), Zuber (M. S.) & Fergason (V.). **Preliminary evidence of resistance of high-amylose corn to the Angoumois grain moth.**—*J. econ. Ent.* **53** no. 4 pp. 573–574, 4 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. When *Sitotroga cerealella* (Ol.), the most important pest of maize stored in the ear in Missouri, was reared in jars on maize ears with amylose contents varying from 0 to 75 per cent., insects that developed on high-amylose kernels showed slower development in the larval stage, lower survival to the adult stage and lower adult weights than those that developed on normal maize, which has an amylose content of about 27 per cent. The possibility of using this insect to separate kernels with different amylose contents is discussed.

Kirk (R. E.) & Wilson (M. C.). **The effect of seed treatments with phorate and other systemic insecticides on the germination of wheat.**—*J. econ. Ent.* **53** no. 4 pp. 575–577, 4 graphs, 3 refs. Menasha, Wis., 1960.

In view of the desirability of protecting wheat from attack by *Mayetiola* (*Phytophaga*) *destructor* (Say) with systemic insecticides instead of by delayed sowing, greenhouse tests were made in Indiana in 1958 to ascertain the effect of seed treatments on germination. Phorate and SD-3562 (dimethyl 1-dimethylcarbamoyl-1-propen-2-yl phosphate) reduced germination from about 80 per cent. to 43 and 52 per cent., respectively, when used at

0·75 lb. and to 23 per cent. and zero at 1·5 lb. per 100 lb. seed, whereas Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate) did not affect it. In a factorial experiment with 0·18–1·5 lb. phorate per 100 lb. seed, six fungicides and five adhesives, the results suggested that certain fungicides and adhesives interacted with the insecticide to reduce its phytotoxicity. Reductions in the viability of seed treated with phorate increased with the interval between treatment and sowing, but this appeared to be largely due to the adhesive. It is concluded that the addition of a fungicide such as captan or thiram (Arasan) and an adhesive consisting of dextrin, sorbitol and water (6:3:1) would greatly reduce the phytotoxicity of phorate, applied at the rate of 0·2–0·3 lb. per 100 lb. seed for insect control.

Buchanan (W. D.). **Insects associated with wounds on trees that develop oak wilt.**—*J. econ. Ent.* **53** no. 4 pp. 578–581, 3 figs., 6 refs. Menasha, Wis., 1960.

The following is based on the author's abstract. Observations in five three-acre plots of black oak [*Quercus velutina*] and scarlet oak [*Q. coccinea*] in south-eastern Missouri in 1955–58 showed significantly more oak wilt, caused by *Ceratocystis fagacearum*, on trees that were injured with an axe or bored with an auger than on similar trees punctured with a miners' pick or not wounded. Any development of wilt occurred in the season in which the trees were damaged, but there was none on trees that were wounded before 11th April or after 6th May. Various insects were caught in traps attached over auger holes on trees that subsequently developed wilt, and it seemed likely that some of them (cockroach nymphs and carpenter ants) carried the fungus to the trees, but the source of the inoculum was unknown, as no fungus mats or other recognised sources of wilt were found in or round the plots.

Luckmann (W. H.). **Increase of European corn borers following soil application of large amounts of dieldrin.**—*J. econ. Ent.* **53** no. 4 pp. 582–584, 8 refs. Menasha, Wis., 1960.

The following is substantially the author's abstract. In 1954–58, about 17,844 acres of farm land near Sheldon, Illinois, were treated with 2–3 lb. dieldrin per acre for the suppression of a local infestation of *Popillia japonica* Newm. Surveys of field maize each year showed higher populations of *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) in fields within the treated area than in fields surrounding it; they averaged 2·6 more larvae per infested stalk in the treated area than in the untreated area in 1954 and 1955, when infestations were very heavy. In 1955, field maize was slightly more attractive for oviposition and permitted slightly higher survival of the larvae within the treated area, but the increase in attractiveness did not completely account for the great increase in numbers of larvae. Some predators commonly found in maize fields were not adversely affected by dieldrin, including *Orius insidiosus* (Say), Nabids, Chrysopids and Syrphids; adult and immature Coccinellids were numerous and the parasite, *Lydella stabulans* var. *grisescens* R.-D., was equally abundant in treated and untreated areas. The factors responsible for the increase were not ascertained, but the results indicated that the size of the treated area was important; the increase was not great enough to warrant additional control measures.

Swailes (G. E.). **Influence of soil and moisture on the beet webworm, *Loxostege sticticalis*, and its parasites.**—*J. econ. Ent.* **53** no. 4 pp. 585–586, 2 graphs, 3 refs. Menasha, Wis., 1960.

Outbreaks of *Loxostege sticticalis* (L.) lasting several years occur periodically in the prairie region of Canada, and laboratory tests on the effect of burying the cocoons on the survival and emergence of the Pyralid and its parasites were carried out in the winter of 1949–50. The cocoons were exposed on the surface or covered with 2–6 in. of sand, silt-loam or clay, with moisture contents of 0–17, 3–23 and 4–29 per cent., respectively, in jars. The mortality of prepupae and pupae increased with increasing depth in each soil type and with increasing moisture in the sand and silt-loam, and there was about 30 per cent. mortality of adults in cocoons on the surface and almost complete mortality of those from buried cocoons. About 31 per cent. of the cocoons used were parasitised, and 41, 18, 17 and 9 per cent. of *Meteorus loxostegei* Vier., *Neopristomerus* (*Pristomerus*) *appalachianus* (Vier.), *Cremnops vulgaris* (Cress.) and *Campoplex* sp. and 15 per cent. of the hyperparasitic *Mesochorus perniciosus* Vier. reached the adult stage. Soil type had little effect on parasite survival, but moisture had considerable effect, and depth of burial affected emergence from the soil to some extent. However, even the six-inch depth permitted considerable numbers of parasites to emerge. It is concluded that tillage to bury the cocoons to a depth of 2 in. would help to prevent emergence of *L. sticticalis*, while preserving many parasites.

Wallesz (D. P.) & Benjamin (D. M.). **The biology of the pine webworm, *Tetralopha robustella*, in Wisconsin.**—*J. econ. Ent.* **53** no. 4 pp. 587–589, 1 fig., 9 refs. Menasha, Wis., 1960.

The following is based on the authors' abstract. *Tetralopha robustella* Zell., which is widely distributed throughout the eastern United States and has been recorded on ten species of pine, is a potential pest in Wisconsin as a defoliator of red pine (*Pinus resinosa*) and jack pine (*P. banksiana*). Investigations on the bionomics of the Pyralid [*cf. R.A.E.*, A **24** 659], carried out in a plantation of red pine and a natural stand of jack pine, indicated that the larvae overwinter in sand-covered cocoons in the upper inch of soil under the trees, pupate in early June and transform to adults about two weeks later. Oviposition occurs between early July and mid-August. The larvae hatch from early July, spend at least the first instar mining the needles and then construct frass shelters, over several adjacent needles, in which they live in groups for the rest of the feeding period. They enter the ground to overwinter between mid-September and mid-November. Eight insect parasites and two species of predacious insects were found attacking the larvae, and birds destroyed those in the higher branches.

Burbutis (P. P.), VanDenburgh (R.), Bray (D. F.) & Ditman (L. P.). **European corn borer control in peppers.**—*J. econ. Ent.* **53** no. 4 pp. 590–592, 1 fig., 3 refs. Menasha, Wis., 1960.

Menzer (R. E.), Burbutis (P. P.), Hofmaster (R. N.) & Ditman (L. P.). **DDT residue studies on peppers.**—*T.c.* pp. 622–624, 3 refs.

In 1956–59, heavy infestations by *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) greatly reduced the yield of peppers [*Capsicum*] in Delaware and parts of

Maryland and Virginia, and caused rejection of the fruits at canneries. Field experiments begun in Delaware in July 1959, in which sprays were applied through nine nozzles per row from a boom that covered four rows, are described in the first of these papers. Examination of red peppers and marketable green peppers at harvest showed that, at 2 lb. per acre, wettable DDT and Sevin gave excellent control, but that toxaphene, in emulsion spray, was ineffective. There were no significant differences between 8–10 weekly applications and seven at 10-day intervals, between applications with and without an adhesive (Plyac) in a seven-day schedule, or between wettable-powder and emulsion formulations or rates of 1 and 2 lb. per acre for DDT. Continuous protection by insecticides was necessary during periods of adult flight, oviposition and hatching, but the excellent control given by 2 lb. DDT in either form with 4 oz. Plyac per acre applied at 10-day intervals suggests that the less frequent applications are adequate. *Protoparce sexta* (Joh.) and *Trichoplusia ni* (Hb.) were numerous in untreated plots, but rare in those sprayed with DDT or Sevin. Populations of *Myzus persicae* (Sulz.) were high in August and September, particularly in the DDT plots, and were not controlled by malathion sprays at the recommended rates.

In the second paper, the residues left by the DDT treatments are considered, and the following is substantially the authors' summary of the investigations. Residues (in parts per million) were considerably higher on the whole plants than on the fruits, and doubling the dosage did not necessarily double the residue on either. The average residues were above the tolerance of 7 p.p.m. immediately after treatment with 2 lb. DDT per acre, but not after 1 lb., and they were below the tolerance seven days after all treatments but that with 2 lb. DDT and adhesive. The residues on the fruits were reduced by processing, and those in the canned product were below the tolerance. Residues were well below tolerance on fruits seven days after they had been treated with 2 lb. DDT per acre by air-blast equipment.

Hodson (A. C.) & Cook (E. F.). **Long-range aerial transport of the harlequin bug and the greenbug into Minnesota.**—*J. econ. Ent.* **53** no. 4 pp. 604–608, 5 maps, 3 refs. Menasha, Wis., 1960.

The following is virtually the authors' abstract. On 4th May 1959, *Murgantia histrionica* (Hahn) appeared in large numbers in a restricted locality in southern Minnesota, and 14 days later, an outbreak of *Toxoptera graminum* (Rond.) on cereals was discovered in the same general area. A study of weather records for the first four days of May showed that factors particularly favourable for long-range aerial transport of insects could have enabled them to be carried to Minnesota from areas to the south and south-west, where they were known to be abundant. The possible prediction of future major outbreaks of *T. graminum* is discussed briefly.

Hitchcock (S. W.). **Effect of an aerial DDT spray on aquatic insects in Connecticut.**—*J. econ. Ent.* **53** no. 4 pp. 608–611, 18 refs. Menasha, Wis., 1960.

Woodlands in Connecticut are sprayed by aeroplane with 1 lb. DDT per acre in fuel oil, mainly for the control of *Lymantria* (*Porthetria*) *dispar* (L.), and ten samples were taken from areas 1 ft. square in each of four streams before and after the application of such a spray and in one untreated stream, to find whether it caused a loss of insects. Each stream contained insects

of about 35 genera before treatment, and, apart from those that disappeared owing to adult emergence, only two genera were eliminated from all the treated streams. Losses in individual streams varied considerably, involving nearly half the genera in some, but one application of spray, as now practiced, did not appear to have a dangerous effect.

Strong (F. E.). **Sampling alfalfa seed for clover seed chalcid damage.**—*J. econ. Ent.* **53** no. 4 pp. 611–615, 7 refs. Menasha, Wis., 1960.

The production of lucerne seed in the western United States is seriously affected by a species of *Bruchophagus* here referred to as *B. gibbus* (Boh.) [but *cf. R.A.E.*, A **49** 28, etc.], and investigations on its control are being made. The author presents a method for rapid determination of the percentage infestation in a sample of harvested seed and examines the components of variance associated with the individual steps in making such a determination. An optimum sampling scheme, by which the mean percentage infestation can be estimated within 15 per cent. of the true mean, 95 per cent. of the times, involved subsampling two field samples per treatment twice and making two separate estimates of infestation on each subsample. The subsamples were threshed, partly cleaned and poured on paper bearing three narrow strips of rubber cement, to cover the paper uniformly. When the cement had set, the excess seed was poured off and the attached seeds examined by microscope to determine the percentage damaged.

Atkins jr. (E. L.). **The beet armyworm, *Spodoptera exigua*, an economic pest of *Citrus* in California.**—*J. econ. Ent.* **53** no. 4 pp. 616–619, 1 fig., 10 refs. Menasha, Wis., 1960.

The author discusses the nomenclature, distribution and bionomics of *Spodoptera exigua* (Hb.), which caused economic damage to young *Citrus* plants in the summer and autumn in 1957–59 in several widely separated areas in California. The life-cycle lasts 30–60 days in summer and autumn, and the plants are attacked by at least four consecutive generations a year. The larvae destroy the expanding foliage and terminal shoots in young plantations and nursery beds, and this materially reduces growth, causing infested trees to develop only half as fast as uninfested ones. Each succeeding flush of growth may be destroyed, and the planting of new combinations of rootstock and scion, which grow 2–3 times as fast as earlier ones and provide a continuous supply of succulent foliage, results in optimum development of the larvae and probably explains their ability to adapt themselves to *Citrus*. No parasites have been observed attacking *S. exigua* on this food-plant. Sprays of 2 lb. 50 per cent. wettable DDT or 25 per cent. wettable parathion per 100 U.S. gal. gave excellent control, but had to be applied every 2–3 weeks for adequate protection, as reinfestation was continuous. Malathion and Sevin were less effective.

Hofmaster (R. N.), Bray (D. F.) & Ditman (L. P.). **Effectiveness of insecticides against the European corn borer and green peach aphid on peppers.**—*J. econ. Ent.* **53** no. 4 pp. 624–626, 2 refs. Menasha, Wis., 1960.

Ostrinia (*Pyrausta*) *nubilalis* (Hb.) has three generations a year on the Eastern Shore of Virginia, with peaks of adult emergence about 10th May,

1st July and 10th August. It causes serious damage to peppers [*Capsicum*], and as oviposition practically ceases after 7th September and peppers maturing in late September or October are virtually undamaged, production has been largely limited to the autumn crop, the plants being set in late July. Since this reduces production and there is an increasing demand for peppers early in the season, methods of controlling the insect were tested in 1959 [*cf. R.A.E.*, A **49** 368]. The following is based on the authors' summary of the results. Four weekly applications of 1 lb. DDT, Sevin, phosphamidon or azinphos-methyl (Guthion) per acre in foliage sprays were quite effective in reducing infestation by the second generation, and 0·5 lb. endrin per acre gave promising results. None of the treatments had any appreciable effect on fruit size or yield. In tests against the third generation, seven applications of a spray of 4 lb. per acre of a preparation of *Bacillus thuringiensis* containing 25×10^9 spores per g. were ineffective. Dimethoate, phosphamidon, azinphos-methyl, endrin and Thiodan controlled *Myzus persicae* (Sulz.), which became abundant both on plots treated with DDT, Sevin or *B. thuringiensis* and on the untreated plots.

Andres (L. A.) & Prout (T.). **Selection response and genetics of parathion resistance in the Pacific spider mite,** *Tetranychus pacificus*.—*J. econ. Ent.* **53** no. 4 pp. 626–630, 5 graphs, 6 refs. Menasha, Wis., 1960.

The authors describe experiments in California in which a strain of *Tetranychus pacificus* McG. that was suspected of resistance to organophosphorus compounds was collected from cotton and another, probably susceptible, from lucerne, and both were reared in the laboratory and tested with parathion. Dosage mortality curves were obtained for both strains, and the susceptible strain was selected for one generation by treatment with parathion or Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite). Parathion caused an increase in LC50 and produced a population composed of two distinct classes, susceptible and resistant, thus providing evidence for the existence of a major gene for resistance, whereas Aramite appeared to cause a general increase in resistance, accompanied by a possible increase in individual variation. Reciprocal crosses between the original susceptible and resistant colonies and back crosses with the susceptible strain provided further strong evidence for a major mendelian dominant, with resistance to parathion dominant to susceptibility.

Webb (F. E.). **Aerial forest spraying against spruce budworm—a problem of mutual interest in Canada and the United States.**—*J. econ. Ent.* **53** no. 4 pp. 631–633, 9 refs. Menasha, Wis., 1960.

The following is based mainly on the author's abstract. By far the largest amount of aerial forest spraying in both Canada and the United States has been against *Choristoneura fumiferana* (Clem.). Although initial development of the method was based largely on co-operative tests, subsequent full-scale operations in the two countries have been carried out largely on opposite sides of the continent, in New Brunswick [*cf. R.A.E.*, A **48** 142] and Quebec [*cf.* **47** 505] in Canada and in the Pacific Northwest and Rocky Mountain regions of the United States [*cf.* **46** 488; **47** 136]. The author reviews recent operations in the two countries from the point of view of differences in forests and outbreak behaviour and in spraying policy, techniques and effectiveness. Applications of 0·5 lb. DDT per acre have

caused drastic losses of the youngest age classes of Atlantic salmon in New Brunswick, and tests have suggested that aerial spraying with 0·25 lb. DDT in 0·5 U.S. gal. spray per acre, with adequate droplet coverage, may be as effective as the larger doses against the insect and less damaging to aquatic life.

Nerney (N. J.). **Grasshopper damage on short-grass rangeland of the San Carlos Apache Indian Reservation, Arizona.**—*J. econ. Ent.* **53** no. 4 pp. 640–646, 3 figs., 19 refs. Menasha, Wis., 1960.

The following is based on the author's abstract of this account of investigations on the interrelations of range vegetation, grasshopper populations and damage on the short-grass rangeland of the San Carlos Apache Indian Reservation, Arizona, carried out in 1953–55. There were great variations between localities and seasons in the density and composition of the principal plant cover, which consisted of short grass and annual forbs, but stands of perennial grasses, which were the most valuable and dependable forage plants, were more uniform and stable. The most important grasshoppers were *Melanoplus bilituratus* (Wlk.), *M. cuneatus* Scud. and *Aulocara elliotti* (Thos.); all fed on a wide variety of grasses and forbs, but the first two showed a greater preference for forbs than did *A. elliotti*. Populations ranged from 9 to 37 per sq. yd., and the damage to perennial grasses, forbs and annual grasses averaged 23, 26 and 30 per cent., respectively. Total damage and the damage per unit area per grasshopper, which was least in perennial grass, were greatest in July. Damage to perennial grass was greatest where the vegetation was sparse and the grasshopper population high, but the greatest damage per unit area per grasshopper occurred where the vegetation was sparse and the grasshopper population moderate to light. The ground cover of perennial grass was highest where *A. elliotti* was dominant.

Coppel (H. C.) & Norris jr. (D. M.). **Systemic insecticides for control of the introduced pine sawfly, *Diprion similis*, with notes on parasite survival.**—*J. econ. Ent.* **53** no. 4 pp. 648–650, 2 refs. Menasha, Wis., 1960.

Investigations on the control of *Diprion similis* (Htg.) on eastern white pine (*Pinus strobus*) with systemic insecticides were carried out in Wisconsin in 1958–59. In most tests, a dose of 8 g. actual ingredient was introduced into trees, 4–6 in. in diameter at breast height, by injection into holes drilled in the base of the trunk [*cf. R.A.E.*, A **47** 336] or by banding the basal trunk area with the insecticide, and collection of first-generation larvae that dropped from the trees in 1958 showed that mortality occurred more rapidly on trees growing in the open than on those in complete or partial shade. Application of any material by bark banding had little effect, but phorate or demeton injected in July usually began to kill the first-generation larvae after two days and remained effective for about seven days; the mortality of second-generation larvae, caged on the trees after about three weeks, was no greater than on untreated trees, and it is concluded that lethal concentrations do not persist in the needles. Amiton oxalate (Chipman R-6199) began to kill the first-generation larvae after 3–4 days and showed a high degree of toxicity that persisted for two years, controlling

four generations of the sawfly. Injection of 4 g. Shell 3562 (dimethyl 1-dimethylcarbamoyl-1-propen-2-yl phosphate) per tree in 1958 caused about 80 per cent. mortality of the first generation and complete mortality in 96 hours of second-generation larvae caged on the needles. No symptoms of phytotoxicity were observed on any of the trees treated by injection, and Hymenopterous and Dipterous parasites were not adversely affected when caged with foliage from trees so treated.

Finney (G. L.), Puttler (B.) & Dawson (L.). **Rearing of three spotted alfalfa aphid Hymenopterous parasites for mass release.**—*J. econ. Ent.* **53** no. 4 pp. 655–659, 9 refs. Menasha, Wis., 1960.

The parasites, *Praon palitans* Mues., *Trioxys utilis* Mues. and *Aphelinus semiflavus* How., were introduced into California in 1955 and reared in the insectary for liberation against *Therioaphis maculata* (Buckt.) on lucerne [*cf. R.A.E.*, A **48** 226, etc.]. The authors describe the methods used to grow lucerne in the greenhouse and to rear and maintain the aphid in the insectary, and give details of the propagation of each parasite and the numbers distributed. Nearly four million were shipped from the insectaries, chiefly in 1956–57.

Gilmore (J. E.). **Biology of the black cherry aphid in the Willamette Valley, Oregon.**—*J. econ. Ent.* **53** no. 4 pp. 659–661, 3 refs. Menasha, Wis., 1960.

The following is substantially the author's abstract. The bionomics of *Myzus cerasi* (F.) on cherry in the Willamette Valley, Oregon, were studied in 1956, since heavy reinfestation often developed during the late spring and early summer, despite early-season control. Evidence was found of considerable movement of the winged summer migrants from one cherry tree to another to feed and reproduce. It had been believed that these forms migrated directly to alternative food-plants in summer, but no aphids were found on suitable plants in 1956, although no males appeared to be produced on cherry. It was estimated that 12 complete generations and a partial thirteenth were produced in the season; the life-cycle ranged from 11·3 days in the ninth generation to 35·9 days in the twelfth, and the average number of nymphs per female per day was 1·1–1·9. The aphid was preyed on by *Hippodamia quinquesignata ambigua* Lec., *Cycloneda polita* Csy., *Syrphus vitripennis* Mg. and *Ephedrus nitidus* Gah. and parasitised by *Aphidius* (*Lysiphlebus*) *knowltoni* Smith, none of which is thought previously to have been recorded from it, in addition to being attacked by *Adalia bipunctata* (L.) and *Chrysopa* sp.

Eichmeier (J.) & Guyer (G.). **An evaluation of the rate of reproduction of the two-spotted spider mite reared on gibberellin-treated bean plants.**—*J. econ. Ent.* **53** no. 4 pp. 661–664, 9 refs. Menasha, Wis., 1960.

An experiment to determine whether populations of *Tetranychus telarius* (L.) were affected by rearing on snap beans treated with gibberellin was carried out in the laboratory in 1958. The plants were grown from seed treated with a gibberellin slurry or were treated 1–3 times at five-day intervals with an aerosol, and there were significant reductions in mite populations on some of them, apparently owing to factors other than direct plant growth.

When mites were transferred from treated to untreated plant material, the rate of reproduction increased rapidly, and when they were transferred from untreated to treated material, it fell within one generation.

Harding (J. A.). **Control of the lesser cornstalk borer attacking peanuts.**– *J. econ. Ent.* **53** no. 4 pp. 664–667, 6 refs. Menasha, Wis., 1960.

Field investigations in 1958–59 on the control of *Elasmopalpus lignosellus* (Zell.) attacking the autumn crop of groundnuts grown under irrigation in Texas showed that granular insecticides were generally as effective as sprays applied to the base of the plants. Granules affording 2–3 lb. DDT or 1 lb. Di-Syston (O,O-diethyl S-2-(ethylthio)ethyl phosphorodithioate), parathion, phorate or dieldrin per acre were very effective in reducing larval damage. In sprays, applied at 5–20 U.S. gal. per acre, 0·5 lb. endrin, parathion, azinphos-methyl (Guthion) or SD-4402 (1,3,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanophthalan), 0·75 lb. Thiodan and 1 lb. DDT per acre were the most effective of the materials tested, but the residual effect of either formulation was limited by the sprinkler irrigation used. In one test, 1 lb. parathion per acre was as effective in 10 or 80 U.S. gal. spray per acre as in granules, and 2 lb. DDT gave somewhat similar results.

Klement (W. J.) & Randolph (N. M.). **The evaluation of resistance of seedling alfalfa varieties and strains to the spotted alfalfa aphid,** *Therioaphis maculata*.—*J. econ. Ent.* **53** no. 4 pp. 667–669, 8 refs. Menasha, Wis., 1960.

The following is substantially the authors' abstract. Four outdoor experiments were carried out in Texas in the spring and summer of 1959 to determine the degree of resistance of lucerne plants to attack by *Therioaphis maculata* (Buckt.). Of about 30 varieties tested, Cody, Lahontan and Moapa showed the highest degrees of resistance, Zia was moderately resistant and six others were slightly susceptible. In at least one experiment, there was significantly less plant injury to each slightly susceptible variety than to the remaining varieties tested, which were susceptible to degrees that varied somewhat in the different experiments.

Dominick (C. B.). **Control of the corn root webworm.**—*J. econ. Ent.* **53** no. 4 pp. 670–672, 8 refs. Menasha, Wis., 1960.

In the lower Piedmont region of Virginia, *Crambus caliginosellus* Clem. was found to be an important pest of seedling maize when this crop followed a depleted stand of *Lespedeza stipulacea*, with heavy weed growth, on an eroded sandy-loam soil, and control experiments were carried out in 1955 and 1957 on plots of this type of soil, which had previously been largely covered with weeds. Applications of 1 lb. aldrin, chlordane or heptachlor per acre in granules in the seed furrow were very effective in preventing insect damage and increased the yield by about 50 per cent. Aldrin or heptachlor, mixed with fertiliser and applied in the furrow, reduced damage more at 1 lb. than at 0·5 lb. per acre, and seed treatment with 2 oz. 50 per cent. wettable dieldrin per bushel was less effective, though the difference was not significant; the only significant differences in yield were between the higher dosage with fertiliser and no treatment. Poor results were obtained when mixtures of aldrin or heptachlor and fertiliser were placed in a narrow

area to the side of the seed with tractor-mounted equipment during sowing, but broadcasting 1·8–2 lb. aldrin or heptachlor per acre in granules some days before sowing gave excellent control.

Poinar jr. (G. O.) & Gyrisco (G. G.). **Effects of light, temperature, and relative humidity on the diel behavior of the alfalfa weevil,** *Hypera postica*.—*J. econ. Ent.* **53** no. 4 pp. 675–677, 2 graphs, 4 refs. Menasha, Wis., 1960.

Observations in New York in 1958 showed that the adults of *Hypera variabilis* (Hbst.) (*postica* (Gylh.)) crawl up lucerne plants to feed during the night and spend the day among débris on the ground or under the dry lower leaves of the plants, and samples, taken by sweeping in lucerne fields at intervals during a 24-hour period at the end of June and a 2·5-hour period in the early morning of 1st August 1959, indicated that behaviour throughout the 24 hours was related to light intensity rather than to temperature or relative humidity. The numbers of larvae collected showed some variation during the 24 hours, but there was no indication of response to changes in light, temperature or relative humidity. It is concluded that, for a true estimation of population, observations on the adults should be carried out in the late evening or at night.

Pedersen (J. R.) & Brown (R. A.). **X-ray microscope to study behavior of internal-infesting grain insects.**—*J. econ. Ent.* **53** no. 4 pp. 678–679, 1 fig., 5 refs. Menasha, Wis., 1960.

The authors discuss the use of X-rays for the mass determination and estimation of internal infestation of grain by insects [*cf. R.A.E.*, A **39** 246] and describe a more sensitive technique for biological studies of individual insects. Instead of making photographic enlargements from radiographs, radiographs of infested kernels are made with an X-ray microscope, which permits magnification up to 400 diameters. Details of the method are given, and the results obtained with rice weevils, probably *Sitophilus sasakii* (Tak.), in wheat are compared with those given by earlier methods. It is concluded that the new technique permits more comprehensive studies of behaviour, development and response to environmental conditions, by providing sharper and more detailed pictures of greater enlargement.

King (D. R.) & Denman (T. E.). **The life history and seasonal occurrence of the peach twig borer in Texas.**—*J. econ. Ent.* **53** no. 4 pp. 680–681, 2 refs. Menasha, Wis., 1960.

Anarsia lineatella Zell. is the main pest of peaches in central Texas and has proved difficult to control; its seasonal history was therefore investigated in 1958–59 and the findings are here described in detail. Immature larvae overwintered in hibernacula under the bark from mid-September and became active in early February, feeding under the bark until the pink-bud stage and then tunnelling in the developing shoots. There were three complete overlapping generations, a partial fourth and possibly a partial fifth in the season, adults emerging in April–May, early June, July, mid-August to mid-September and mid-September, and the eggs were deposited mainly on the fruits when these were available and on leaves and twigs at other times. The larvae fed on ripe fruits, those of early, medium and late

varieties being attacked by the second, second and third, and third generations, respectively; when fruits were not available, the larvae tunnelled in young shoots.

Beckham (C. M.) & Morgan (L. W.). **On the flight distance of the boll weevil.**—*J. econ. Ent.* **53** no. 4 pp. 681–682, 4 refs. Menasha, Wis., 1960.

In view of the need for detailed population studies of *Anthonomus grandis* Boh. under isolated conditions and for maintaining selected strains in the field free from contamination by others for studies on resistance to insecticides, the distance flown by the adults was investigated. Cotton was sown on 13th May on an island in south-eastern Georgia, about 25·5 miles to the east and 34 miles to the south-east of the nearest cotton fields. Examination at weekly intervals until 24th July showed no signs of weevil activity. A few infested squares were collected on 26th August, and these gave rise to ten adults in early September. Very light infestations were detected in September and October; adults were present from 8th October, and 22 per cent. infestation of squares was found on 5th November. It is concluded that *A. grandis* migrated to this cotton about mid-August and that population studies could safely be made until that date, but that test plots must be situated more than 25·5 miles from other cotton for isolation throughout the season.

Oatman (E. R.). **Parasitism of the overwintering pupae of the melon leaf miner,** *Liriomyza pictella*.—*J. econ. Ent.* **53** no. 4 p. 682, 3 refs. Menasha, Wis., 1960.

In the test described, large samples of melon leaves, heavily infested by larvae of *Liriomyza pictella* (Thoms.), were collected in the San Joaquin Valley of California on 1st November 1955 and exposed to the natural environment in well-ventilated cages until 3rd March 1956, after which they were maintained at room temperature in rearing cages for two weeks. Most of the larvae left the leaves and formed puparia within a week after collection; no adults of *L. pictella* emerged in spring, but 366 Hymenopterous parasites were found, of which two-thirds were *Halticoptera aenea* (Wlk.) [*cf. R.A.E.*, A **49** 28] and the remainder, in order of abundance, *Chrysocharis ainsliei* Crwf., *Opius suturalis* Gah., another species of *Opius*, apparently undescribed, *Derostenus arizonensis* Crwf. and *C. parksi* Crwf. The presence of the parasites in the puparia throughout the winter supports the view that *L. pictella* overwinters in its puparia in soil and plant débris [*cf.* **48** 511].

Batzer (H. O.). **Mined buds, a hibernation site for spruce budworm.**—*J. econ. Ent.* **53** no. 4 pp. 684–685, 1 fig., 4 refs. Menasha, Wis., 1960.

Mature trees of balsam fir [*Abies balsamea*] are considered to be more favourable than non-flowering, immature ones to *Choristoneura fumiferana* (Clem.) [*cf. R.A.E.*, A **40** 303], and the first-instar larvae have been shown to prefer empty staminate flower bracts as overwintering sites. However, trees only 1–3 in. in diameter at breast height, which had never borne staminate flowers and were half a mile from heavily attacked mature stands, were found to have been heavily infested in 1957–59 in Minnesota. Close examination revealed numerous vegetative buds, hollowed out by the larvae

early in the growing season, and these bore a striking resemblance to the empty flower bracts on mature trees; 15–24 per cent. of them were occupied by hibernating larvae in September. The number of these overwintering sites varies with the intensity of defoliation early in the season, but it was estimated that there may be more than 2,000 on a tree 11–16 ft. tall; the number increases each year, as the hollowed buds persist. The use of mined buds for hibernation sites may account for the persistence of infestation in young stands, in which large populations of *C. fumiferana* do not ordinarily survive from year to year.

HOYT (S. C.). **Effect of urea on the control of some apple insects with certain insecticides.**—*J. econ. Ent.* **53** no. 4 p. 685, 2 refs. Menasha, Wis., 1960.

As urea, which is sometimes applied to apple foliage as a source of nitrogen, has been included in early cover sprays against *Cydia* (*Carpocapsa*) *pomonella* (L.) in Washington, its compatibility with DDT was investigated in the laboratory in 1958–59. Tests with eggs isolated over insecticide deposits on apples [*cf. R.A.E.*, A **47** 433] showed averages of 32·1 and 67·9 per cent. reduction of larval entries after treatment with 1 and 2 lb. 50 per cent. wettable DDT per 100 U.S. gal., respectively, and 13·3 and 21·5 per cent. reduction after application of the same sprays with the addition of 5 lb. urea (45 per cent. total nitrogen) per 100 U.S. gal. The differences were significant, and it is evident that the urea, or some impurity in it, impaired control. Residue analysis showed little difference in the DDT deposits, indicating that the reduction was not due to degradation of DDT by urea.

In field tests in 1959, four applications of 2 lb. 50 per cent. wettable DDT per 100 U.S. gal. resulted in 3·7 and 2·9 per cent. infested and superficially injured apples, respectively, and when 5 lb. urea was added to the first two applications, the percentages were 6·9 and 4·5; the differences were not significant. Similar tests showed that the addition of urea did not reduce the effectiveness of Kelthane or Tedion against *Panonychus ulmi* (Koch) or of malathion against *Aphis pomi* Deg.

RACE (S. R.). **A comparison of two sampling techniques for *Lygus* bugs and stink bugs on cotton.**—*J. econ. Ent.* **53** no. 4 pp. 689–690. Menasha, Wis., 1960.

As sweeping with an insect net does not give an adequate estimate of many important cotton pests in New Mexico, including the Mirids, *Lygus lineolaris* (P. de B.), *L. hesperus* Knight and *L. elisus* Van D., and the Pentatomids, *Chlorochroa sayi* (Stål.), *C. ligata* (Say) and *Thyanta custator* (F.), particularly late in the season when the plants are tall, the numbers collected with a standard net and with a mechanical device, which forced blasts of air across the upper 18 inches of two rows of plants and blew the insects from them into muslin collection sacks on each side of the machine, were compared on four dates in July 1958. Considerably more bugs were collected with the machine, but the counts were not consistent enough to establish a predictable ratio between the two collecting methods. The average ratios of the Mirid and Pentatomid populations indicated that the former tend to inhabit the periphery of the plants, where the squares are developing, whereas the latter frequent the inner and lower portions, where the bolls are maturing; this difference allows more Mirids than Pentatomids to be collected with the net.

It is concluded that, late in the season, sampling by net should be used only in conjunction with visual inspection of the plants in the field.

Ridgway (R. L.) & Gyrisco (G. G.). **Evaluation of insecticides for control of the tarnished plant bug on birdsfoot trefoil.**—*J. econ. Ent.* **53** no. 4 p. 690, 3 refs. Menasha, Wis., 1960.

In tests in New York in which insecticides were applied to birdsfoot trefoil (*Lotus corniculatus*) at 1 lb. toxicant in 20 U.S. gal. spray per acre on 2nd August 1959 and compared with aldrin for the control of *Lygus lineolaris* (P. de B.), counts of nymphs and adults collected 2–14 days later showed that dimethoate, Dibrom, trichlorphon (Dylox), Methyl Trithion (O,O-dimethyl S-p-chlorophenylthiomethyl phosphorodithioate) and aldrin gave outstanding control, azinphos-methyl (Guthion) was intermediate in effect and Trithion, Shell 5539 (dimethyl 1-(m-nitrobenzyloxycarbonyl)-1-propen-2-yl phosphate), Sevin and ethion were less effective.

Sullivan (W. N.) & McCauley (T. R.). **Effect of acceleration force on insect mortality.**—*J. econ. Ent.* **53** no. 4 pp. 691–692, 3 graphs, 4 refs. Menasha, Wis.,1960.

Experiments in which adults of *Tribolium confusum* Duv., *Musca domestica* L. and *Popillia japonica* Newm. were subjected to forces of multiple gravity in a centrifuge showed that they were highly resistant to the strains imposed by extreme forces of acceleration, 73 minutes at 20,600, two minutes at 11,400 and from two minutes at 6,250 to 30 minutes at 4,150 times the force of the earth's gravity, respectively, being required to produce 50 per cent. mortality [*cf. R.A.E.*, A **48** 454].

Dean (H. A.). **Introduction and establishment of *Anagyrus antoninae* on Rhodes-grass scale in Mexico.**—*J. econ. Ent.* **53** no. 4 p. 694, 2 refs. Menasha, Wis., 1960.

Antonina graminis (Mask.) was first recorded in Mexico in December 1956 and was found to be widely distributed on pasture grasses in central districts in 1957. Para grass [*Panicum barbinode*], one of the most important grasses for livestock in Mexico, was heavily attacked by the scale, and *Anagyrus antoninae* Timb. was introduced from Texas and liberated against it in 1957–58. In addition, small numbers of *A. diversicornis* Merc. and *Timberlakia europaea* (Merc.), reared from *Antonina purpurea* Sign. in quarantined shipments from France, were liberated in 1959. Infested Para grass was collected in 1959 at Micos, San Luis Potosi, and *Anagyrus antoninae* was found to be established there on *Antonina graminis* one year after its introduction. Parasitism was very high under conditions of continuously high relative humidity and relatively low temperatures, but very low where high daytime temperatures prevailed [*cf. R.A.E.*, A **47** 329].

Asquith (D.). **Insecticides change the importance of segments of insect generations.**—*J. econ. Ent.* **53** no. 4 pp. 694–695. Menasha, Wis., 1960.

The author cites two examples from southern Pennsylvania of the effect of regular applications of highly toxic insecticides over the same short period each year in changing the relative importance of different parts of an insect

generation. Formerly, apples not treated with lead arsenate in the petal-fall and first cover spray became infested by *Cydia* (*Carpocapsa*) *pomonella* (L.) before the second cover spray. Since the introduction of organic phosphorothioates, which are toxic to the adults, larvae and in some cases eggs, in the petal-fall and first cover sprays, it has become rare to find apples infested by early larvae of the first generation on untreated trees, whereas apples not protected against the late larvae of this generation usually become heavily infested, and a spray against this section of the generation has to be included in the schedule. A similar change has occurred in the case of *Argyrotaenia velutinana* (Wlk.) after the use of toxic insecticides within fairly narrow periods for several successive years; sprays applied against the peaks of the three annual generations were formerly adequate, the late larvae of each generation being of little importance, but these have gradually become more numerous and now require control. It is suggested that this sort of selection by insecticides may be second in importance only to selection for resistance.

Blanchard (R. A.), Getzin (L. W.) & Douglas (W. A.). **Control of the corn earworm with American Cyanamid 18133.**—*J. econ. Ent.* **53** no. 4 pp. 695–696. Menasha, Wis., 1960.

In tests carried out in Texas in May 1959 with Am. Cyanamid 18133 (O,O-diethyl O-2-pyrazinyl phosphorothioate) for the control of *Heliothis zea* (Boddie) on sweet maize, 2–3 applications of 10 per cent. granules, shaken from a jar with holes in the lid to cover the silks thoroughly, resulted in 95–100 per cent. uninfested ears and were as effective as three of DDT in emulsion spray. In similar tests in Mississippi in June and early July, three applications of the granules gave complete control and were better than four of DDT in emulsion. In mid-July, 1–3 applications of 7·5 per cent. 18133 granules gave poor control, but four resulted in 95 per cent. uninfested ears and seemed more effective than four applications of 1 lb. 18133 in 25 U.S. gal. emulsion spray per acre, with or without oil. In late July and early August, under poor growing conditions, neither the 10 per cent. granules nor the DDT spray gave good control, but small granules were more effective than large ones.

Lindgren (D. L.) & Vincent (L. E.). **Response of quiescent Khapra beetle larvae to fumigation and to low temperatures.**—*J. econ. Ent.* **53** no. 4 pp. 698–699, 1 fig., 3 refs. Menasha, Wis., 1960.

The authors describe a method of obtaining quiescent larvae of *Trogoderma granarium* Everts by providing crevices in transparent cells [*cf. R.A.E.*, A **47** 375] and give the results of experiments to compare the susceptibility of active and quiescent larvae to fumigation with methyl bromide, hydrogen cyanide and acrylonitrile. Quiescent larvae that had been kept at 60 or 90° F. for about two months from the time they entered the crevices were more resistant than active larvae to fumigation, and quiescent larvae that had been kept at 90° were more and less difficult to kill with methyl bromide and HCN, respectively, than those kept at the lower temperature; it is considered unlikely that penetration of the crevices by the fumigants was delayed. When active larvae and quiescent larvae that had been kept at 60 or 90° F. for 2–3 months were exposed to temperatures of 8–16° F. for 5–12 days, only one adult was obtained from the active larvae, after the shortest exposure, but many were obtained from quiescent larvae, after the longest; there was some indication that the quiescent larvae kept at 60° might be more resistant to the low temperature than those kept at 90°.

Smith (D. S.). **Effects of changing the phosphorus content of the food plant on the migratory grasshopper,** *Melanoplus bilituratus* **(Walker) (Orthoptera: Acrididae).**—*Canad. Ent.* **92** no. 2 pp. 103–107, 17 refs. Ottawa, 1960.

The following is virtually the author's summary. The phosphorus content of wheat was changed by the use of nutrient solutions, and the wheat was used as food for *Melanoplus bilituratus* (Wlk.). Survival, rate of development and fecundity were all greater on wheat with a low-phosphorus content (0·17 per cent. dry weight) than on wheat with a high-phosphorus content (1·86 per cent. dry weight).

Mason (W. R. M.). **New Hymenopterous parasites of lodgepole pine needle miners.**—*Canad. Ent.* **92** no. 2 pp. 140–147, 8 figs. Ottawa, 1960.

The parasites described, all from adults of both sexes, are *Apanteles starki*, *Meteorus pinifolii* and *Aethecerus pinifolii*, spp. n., all from *Recurvaria starki* Freeman on lodgepole pine (*Pinus contorta*) in Alberta and the last two also from *R. milleri* Busck on the same tree in California. The Ichneumonid genus *Aethecerus* is known in Europe, but has not previously been recorded from North America.

Vockeroth (J. R.). **Taxonomy of the genus** *Cecidomyia* **(Diptera: Cecidomyiidae) with special reference to the species occurring on** *Pinus banksiana* **Lamb.**—*Canad. Ent.* **92** no. 1 pp. 65–79, 13 figs., 23 refs. Ottawa, 1960.

Reeks (W. A.). **Observations on the life history, distribution, and abundance of two species of** *Cecidomyia* **(Diptera, Cecidomyiidae) on jack pine in Manitoba and Saskatchewan.**—*T.c.* no. 2 pp. 154–160, 1 fig., 9 refs.

In the first of these papers, the author discusses the scope of the genus *Cecidomyia*, with which *Retinodiplosis* is congeneric, reviews its characters and food-plant range, which, with few exceptions, is restricted to pines (*Pinus* spp.) and gives keys to the larvae, pupae and adult males of the Nearctic species and one to the females of the three that occur on jack pine (*P. banksiana*). These last are described as *C. reeksi*, *C. banksianae* and *C. accola*, spp. n.; all occur in Canada, and the first also in the United States.

It is stated in the second paper that infestations of *P. banksiana* by *C. reeksi* and *C. banksianae*, which was associated with the former in small numbers, were found in Manitoba in 1956; the bionomics of these Cecidomyiids were investigated there between that year and 1958, when populations became very low. Both were collected in various localities in Manitoba and Saskatchewan and at one place in Ontario, and the distribution of *C. reeksi* is thought to coincide with most of the range of *P. banksiana*. Eggs of *C. reeksi*, which were found in the field in Manitoba between 19th May and 12th June, were laid singly on shoots of the current year or on young needles. The larvae hatched in about six days and embedded themselves in resin masses on the current shoots. They are thought to feed on resin, the flow of which may be ensured by injury to the cambium caused mechanically or by extra-intestinal digestion. They overwintered and resumed feeding with the resumption of resin flow in spring. Pupae were present in the resin masses throughout most of May, and the adults emerged between 21st May and 5th June, during the pollination period of the trees; they survived for 1–6 days

in the insectary. Cumulative larval mortality in spring, attributed in part to parasites and in part to weather factors, was high, particularly in 1958 (80–100 per cent.), when, following winter drying, many infested shoots died or produced little or no resin in spring and temperatures were extremely low in late April. In 1957, infestation was significantly heavier in the middle and lighter in the lower layer of the crown than elsewhere, but crown-level differences were not consistent between trees. Of 408 shoots attacked in 1957, 75 per cent. were dead by the following summer, with cambial injury below the resin, but this type of damage is not considered to be important; on trees in which 15 per cent. of the shoots were infested, the effect on growth increment was negligible. The most important damage is to young trees; these are occasionally, and their leaders or branches often, killed.

Eggs of *C. banksianae* were laid singly on the needles or bark near the terminal buds and were present from about 12th to 24th June. The overwintered larvae were embedded by late April in the meristematic tissues near the base of the bud or developing shoot, in a cavity that became filled with resin, and they pupated in early May in cocoons on the needles or bark of year-old shoots. In the insectary in 1957, the adults emerged between 27th May and 4th June. Infested shoots bend at the point of injury and may start to die by 10th May or, if less severely damaged, by about mid-June. The damage is not known to be of economic importance.

Ozaki (K.). **On the difference in the resistance to parathion or methyl parathion of the hibernated rice stem borer reared on different varieties of rice plant.** [*In Japanese.*]—*Botyu-Kagaku* **24** pt. 3 pp. 118–123, 2 graphs, 4 refs. Kyoto, 1959. (With a summary in English.)

Overwintered larvae of *Chilo suppressalis* (Wlk.) from rice of different varieties in Japan showed differences in their susceptibility to emulsion sprays of parathion and topical treatment with methyl-parathion in acetone, those from one variety being much less affected than the others. Difference in the body weight of the larvae was slight.

Washizuka (Y.) & Kuwana (S.). **The effect of some agricultural chemicals on a wasp, *Trichogramma japonicum* Ashmead, an egg parasite of the rice stem borer, *Chilo suppressalis* Walker.** [*In Japanese.*]—*Botyu-Kagaku* **24** pt. 3 pp. 137–140, 1 graph, 10 refs. Kyoto, 1959. (With a summary in English.)

When eggs of *Chilo suppressalis* (Wlk.) parasitised by *Trichogramma japonicum* Ashm. and unparasitised eggs were dipped in preparations of six insecticides, the results showed that both host and parasite were most affected by parathion and least affected by DDT and malathion. Endrin, γ BHC (lindane) and diazinon affected the parasite more than the host. The effects differed somewhat with the age of the eggs.

Tsukamoto (M.). **Metabolic fate of DDT in *Drosophila melanogaster*. I. Identification of a non-DDE metabolite.**—*Botyu-Kagaku* **24** pt. 3 pp. 141–151, 6 graphs, 39 refs. Kyoto, 1959. (With summaries in Japanese & French.)

The following is virtually the author's summary. When DDT-resistant strains of *Drosophila melanogaster* Mg. were reared on DDT-containing media,

no DDE was found in the ether extract of larvae, pupae and adults, using a non-aqueous paper chromatographic system, whereas another metabolite with an Rf-value lower than that for DDT was detected. When *Drosophila* was reared on DDE-containing media, no metabolite was produced, indicating that DDE is not a precursor of this unknown metabolite. Of the several derivatives of DDT tested, only Kelthane had the same chromatographic behaviour as this metabolite, using both an aqueous and a non-aqueous paper chromatographic system. The elution character for the unknown metabolite coincided with that for Kelthane in column chromatography. The ultraviolet absorption curve for the metabolite was also identical with that for Kelthane. The chloroform formation test by the Fujiwara reaction was positive for the metabolite and Kelthane, whereas DDT, DDE, DDD (TDE), FW-152 (1,1-di(p-chlorophenyl)-2,2-dichloroethanol), etc., were negative. It is concluded that in *Drosophila* DDT is metabolised to its hydrol-type derivative, Kelthane, and not to DDE.

Kamiya (H.). **On the identity of** *Stethorus punctillum* **of Japanese authors (Coleoptera: Coccinellidae).** [*In Japanese.*]—*Kontyû* **27** no. 2 pp. 140–143, 2 figs. Tokyo, 1959.

A predacious Coccinellid previously considered in Japan to be *Stethorus punctillum* Weise is described in English from adults of both sexes as *S. japonicus*, sp.n.; it attacks mites and Coccids. So far as the author is aware, the true *S. punctillum* does not occur in Japan.

Lin (P. C.) & Huang (M. S.). **Report on a survey of the life of** *Balaninus camelliae* **Roelofs.** [*In Chinese.*]—*Agric. Res.* **7** no. 3 pp. 26–36, 13 figs. Taipei, Formosa, 1957.

Curculio (*Balaninus*) *camelliae* Roel. caused little damage to tea in Formosa until 1953, but has since multiplied and become injurious in the gardens of the experiment station at Nantou Hsien. This weevil has one generation a year; the eggs are laid in the unripe seeds, usually singly but sometimes 2–3 in a seed, in late May and hatch in early June. The larvae feed in the seeds for about 5–6 months, and then drop to the ground and hibernate about 8–12 in. below the surface. Pupation begins in mid-April, and the adults emerge after 10–18 days, in early May.

Tao (Chia-hwa) & Sui (Kwa-yann). **Application's schedules for the control of spiny bollworm (***Earias fabia* **Stoll) in Taiwan in 1955.** [*In Chinese.*] —*Agric. Res.* **7** no. 4 pp. 43–48, 2 refs. Taipei, Formosa, 1957.

The authors describe experiments on the control of *Earias fabia* (Stoll) on cotton in Formosa, in which sprays of 0·025 per cent. endrin alone or with 0·0625 per cent. DDT in emulsion spray, or 0·125 per cent. wettable dieldrin with 0·0625 per cent. DDT were applied 4–6 times. All treatments increased the numbers of bolls per plant and reduced the percentage infested, with no difference between insecticides. All treatments increased the yield of seed cotton, and five or six applications, which did not differ significantly from each other, were better than four.

Cumber (R. A.). **The insect complex of sown pastures in the North Island. I. The general picture revealed by summer sweep-sampling.**—*N.Z. J. agric. Res.* **1** no. 5 pp. 719–741, 20 figs., 9 refs. Wellington, N.Z., 1958. **II. The Hemiptera as revealed by summer sweep-sampling.**—*Op. cit.* **2** no. 1 pp. 1–25, 16 maps, 26 refs. 1959. **III. The Diptera as revealed by summer sweep-sampling.**—*T.c.* no. 4 pp. 741–762, 17 maps, 29 refs. **IV. The Coleoptera as revealed by summer sweep-sampling.**—*T.c.* pp. 763–772, 3 maps, 12 refs. **V. The Hymenoptera as revealed by summer sweep-sampling.**—*T.c.* no. 5 pp. 874–897, 24 maps, 16 refs. **VI. The Psocoptera and Neuroptera as revealed by summer sweep-sampling.**—*T.c.* pp. 898–902, 2 maps, 6 refs. **VII. The Thysanoptera as revealed by summer sweep-sampling.**—*T.c.* no. 6 pp. 1123–1130, 7 maps, 18 refs. **VIII. The Orthoptera as revealed by summer sweep-sampling.**—*T.c.* pp. 1131–1136, 3 maps, 12 refs. **IX. The Lepidoptera as revealed by summer sweep-sampling.**—*Op. cit.* **3** no. 1 pp. 24–33, 5 maps, 17 refs. 1960. **X. Insects revealed in studies of soil, turf, and dung.**—*T.c.* no. 2 pp. 253–267, 4 maps, 18 refs.

The first nine parts of this series contain the results of a survey of the insect fauna of sown pastures, made throughout the North Island of New Zealand in the summer of 1957. The first of them includes an account of the techniques adopted, the types and distribution of the 113 pastures sampled, an appraisal of the efficiency of the sweeping technique, and analyses of the specimens, orders and species (of which over 270 were found) that were collected in the pastures and from adjoining roadsides. In the later ones are given notes on the distribution, abundance and possible economic importance of the species collected, arranged by orders. The tenth contains similar information on species collected from cattle dung and during examinations of soil and turf in the summer and spring of 1957 and the spring of 1958.

Lamb (K. P.). **Field trial of eight varieties of *Brassica* field crops in the Auckland district. I. Susceptibility to aphids and virus diseases.**—*N.Z. J. agric. Res.* **3** no. 2 pp. 320–331, 2 graphs, 9 refs. Wellington, N.Z., 1960.

The following is based almost entirely on the author's summary. Under field conditions in New Zealand, one variety of rape and one of four varieties of swede were highly susceptible to attack by *Brevicoryne brassicae* (L.), another variety of swede and marrow-stem kale were moderately susceptible, the remaining two varieties of swede were resistant and two of turnip were highly resistant. The varieties did not show the same order of resistance towards *Myzus persicae* (Sulz.) as towards *B. brassicae*. The resistant varieties of swede and marrow-stem kale were highly resistant to infection with turnip mosaic, while these varieties together with the moderately susceptible variety of swede were moderately resistant to cauliflower mosaic. The turnip varieties had a high incidence of both virus diseases, of which *B. brassicae* is the main vector, and virus disease was the primary cause of plant mortality. The time of virus infection was correlated with aphid flights. It is suggested that part of the difference in virus incidence was due to vector behaviour. Marrow-stem kale and one of the resistant varieties of swede were outstanding for winter survival and yield. The other resistant swede and the moderately susceptible one were next best, but none of the other varieties was satisfactory.

Hoy (J. M.). **Preliminary assessment of toxaphene, Strobane and Thiodan for control of clover case-bearers** (*Coleophora* **spp.**) (**Coleophoridae, Lepidoptera**).—*N.Z. J. agric. Res.* **3** no. 4 pp. 617–622, 4 refs. Wellington, N.Z., 1960.

The following is based almost entirely on the author's summary. In an unreplicated field experiment carried out in the North Island of New Zealand between December 1957 and March 1958, in which areas of five acres or more were used for each treatment, toxaphene applied in sprays three times at a total rate of 15 lb. per acre to white clover [*Trifolium repens*] in flower increased seed yields approximately five times and reduced seed damage caused by *Coleophora spissicornis* (Haw.) and the species tentatively determined as *C. alcyonipennella* (Koll.) [*cf. R.A.E.*, A **48** 247] from 29·7 to 12·1 per cent. In laboratory tests, toxaphene and Strobane at the equivalent of 10 lb. per acre did not cause significant mortality in final-instar larvae of *C. alcyonipennella* after exposure for 48 hours. Under the same conditions, Thiodan at 5 lb. per acre caused 60 per cent. mortality. Toxaphene and Strobane are apparently highly toxic only to the adults of *Coleophora* spp.; they may be used while clover is in flower with minimum risk to honey bees [*cf.* **48** 370], but Thiodan may be toxic to honey bees when used on flowering crops. Further trials with toxaphene and Strobane appear warranted.

Richards (A. M.). **Scale insect survey on apples 1959–60.**—*N.Z. J. agric. Res.* **3** no. 4 pp. 693–698, 3 refs. Wellington, N.Z., 1960.

The following is based largely on the author's summary and conclusions. A survey in 1959–60 showed the presence of Coccids of seven species on apple in New Zealand. They are *Quadraspidiotus perniciosus* (Comst.), *Q. ostreaeformis* (Curt.), *Lepidosaphes ulmi* (L.), *Aonidiella aurantii* (Mask.), *Parlatoria pittospori* Mask., *P. virescens* Mask. and *Hemiberlesia* (*Aspidiotus*) *rapax* (Comst.). The first five caused red marks on the fruits, rendering them unacceptable for export. *Q. ostreaeformis* has not hitherto been recorded from New Zealand, and *P. virescens* and *A. aurantii* are recorded for the first time infesting fruit and causing red marks on apple, respectively. *Q. perniciosus* is the species of greatest economic importance; though absent from Canterbury and Otago, where it is replaced by *Q. ostreaeformis*, it is the most widespread, and in addition it produces three generations each season. Predacious mites and parasites were found in some orchards, but many natural enemies have been killed by extensive spraying. The paper includes keys for the separation of the Coccids and a table indicating the species recorded on each of 24 apple varieties.

Watson (M. A.) & Mulligan (T. E.). **Comparison of two barley yellow-dwarf viruses in glasshouse and field experiments.**—*Ann. appl. Biol.* **48** no. 3 pp. 559–574, 1 pl., 3 graphs, 15 refs. London, 1960.

An avirulent strain of the barley yellow-dwarf virus was found in barley at Rothamsted in 1954. It was experimentally transmitted by *Rhopalosiphum padi* (L.), *Macrosiphum* (*Sitobion*) *fragariae* (Wlk.), *M.* (*Metopolophium*) *dirhodum* (Wlk.) and *Myzus circumflexus* (Buckt.). It decreased the yield of barley in 1955, but the results obtained in tests with barley and other cereals in 1956 were variable. The virus caused severe damage to oats in the south and west of England in 1957, and some of the strains isolated seemed much more virulent than the Rothamsted one.

Subsequently, comparisons were made of the host ranges, interactions in infected plants, and effects on yields of cereals of the avirulent Rothamsted strain (RV) and a virulent strain (KV) obtained from Kent, and the following is based on the authors' summary of the results. The two strains resembled each other and the American yellow-dwarf viruses [*cf. R.A.E.*, A **43** 268; **49** 114, etc.] in their ability to infect wild grasses, but differed in their ability to infect inbred lines of the same grass species. KV infected and caused symptoms to develop in rice and rye, each of one variety, and one of two varieties of maize. Plants that were infected first with RV and later, when symptoms had fully developed, with KV, suffered the same loss of yield from KV as did plants infected for the same length of time with KV alone. Similarly, *R. padi*, when allowed to feed first on sources of RV and then on KV, transmitted mainly KV, so that there was no evidence of protection in the insect vector. Effects on yield of cereals were related to the time of appearance and intensity of symptoms. The effect of RV was not only less than that of KV, but was also more variable.

Mulligan (T. E.). **The transmission by mites, host-range and properties of ryegrass mosaic virus.**—*Ann. appl. Biol.* **48** no. 3 pp. 575–579, 1 pl., 8 refs. London, 1960.

A virus that causes chlorotic streaks on the leaves of rye grass (*Lolium perenne* and *L. multiflorum*) in England was transmitted in laboratory investigations by the Eriophyid, *Abacarus hystrix* (Nal.), which had previously been found on all of four samples of diseased leaves examined. Virus-free mites acquired the virus from infected *L. multiflorum* in a two-hour feeding period, and the proportion that became infective increased with increased feeding time up to 12 hours; vectors lost infectivity within 24 hours of leaving the infected leaves. Both nymphs and adults of *A. hystrix* were vectors. The virus was transmitted by manual inoculation of sap to several other grasses and to cereals; its other properties are described.

Burt (P. E.), Broadbent (L.) & Heathcote (G. D.). **The use of soil insecticides to control potato aphids and virus diseases.**—*Ann. appl. Biol.* **48** no. 3 pp. 580–590, 1 graph, 8 refs. London, 1960.

The following is almost entirely the authors' summary. A replicated trial was carried out in southern England in 1958 to find whether phorate (Thimet) and dimethoate (Rogor), applied as systemic insecticides in the soil, affected the spread of aphid-transmitted viruses from infected to healthy plants within potato crops. The insecticides were applied at planting as activated carbon formulations at rates of 9½–10½ lb. toxicant per acre, and infected plants were removed in late June. Phorate applied along the furrows with the fertiliser and dimethoate applied in individual doses beneath each tuber kept the plants free from aphids, chiefly *Myzus persicae* (Sulz.), from a week after the plants emerged until early August. Phorate in individual doses was less effective, but greatly decreased the aphid infestation. All treatments prevented or greatly decreased the spread of leaf-roll virus, but only slightly decreased that of virus Y [*cf. R.A.E.*, A **44** 409]. None of the treatments damaged the plants or depressed the yields significantly. Tubers harvested from the treated plots contained only very small quantities of the insecticides, but shoots from them, when infested with adults of *M. persicae*, bore fewer aphids a week after infestation than did shoots from control tubers. Shoots of tubers from treated plots also grew more slowly than those from the

controls. The aphicidal efficiency of phorate applied as individual doses separated from the tubers by distances of up to 6 in. decreased as the distance increased, but the effect of distance became less as time passed. Reasons for the differences in the behaviour of the insecticides and the possibilities that the method offers for the control of virus diseases are discussed. The application of insecticides to soil promises to be a useful way of controlling the spread of viruses, provided that the harvested crop is free from toxic residues.

Tarr (S. A. J.). **The effects of fungicide-insecticide seed treatments on emergence, growth and yield of irrigated cotton in the Sudan Gezira.**—*Ann. appl. Biol.* **48** no. 3 pp. 591–600, 9 refs. London, 1960.

The following is substantially the author's summary. In investigations in 1955–57, treatment of the seed with a mercury fungicide and an insecticide (of which two of each were tested), particularly with methoxyethyl-mercuri-acetate (MEMA) and dieldrin, often improved germination, growth and yield of irrigated Egyptian-type cotton (*Gossypium barbadense*) in the Sudan Gezira. Such treatment reduced post-emergence wilting and death of seedlings resulting from termite attack, and also reduced pre-emergence mortality probably caused primarily by soil insects, but appeared to have little effect on the incidence of termite damage to tap-roots of mature plants at the end of the season. Termite attack tended to be more severe in close rotations, and the beneficial effects of fungicide–insecticide seed treatment were greater in three-course than in four-course rotation plots. In one experiment, treatment improved growth and yield of cotton plants in the apparent near-absence of insect pests and diseases, this effect perhaps deriving from control of minor root damage caused by soil insects or fungi. Certain seed treatments, notably those containing MEMA and γ BHC, were slightly phytotoxic, but at the levels applied (0·043 parts mercury and 0·12–0·24 parts insecticide per 100 parts seed) this aspect, although needing further investigation, seems unlikely to be of serious practical significance in the Gezira, where high sowing rates are the rule; any slight phytotoxicity would probably be outweighed by the protective effects of the treatment. Phytotoxicity tended to become more pronounced with increasing number of seeds per sowing hole.

Daiber (C. C.) & Schöll (S. E.). **Further notes on the overwintering of the green peach aphid, *Myzus persicae* (Sulzer), in South Africa.**—*J. ent. Soc. S. Afr.* **22** no. 2 pp. 494–520, 5 graphs, 33 refs. Pretoria, 1959.

The following is based on the authors' summary. The overwintering of *Myzus persicae* (Sulz.) in South Africa [*cf. R.A.E.*, A **48** 312] was studied in 1957–58 in a municipal area (Pretoria), a Highveld farm without irrigation (Rietvlei) and a farm on a Northern Cape Province irrigation scheme (Rietriver). Holocyclic overwintering was observed on peach trees. Gynoparae were first found at Rietvlei, then at Pretoria and finally at Rietriver. Their development seemed to be released when the temperature fell below a threshold of 18°C. [64·4°F.] [**48** 313], passed at the three places in the order given. Oviposition was most abundant where peach trees were surrounded by many secondary food-plants, where the temperature curve dropped gradually and on twigs that retained their leaves the longest. After the eggs had passed through a short resting stage, a small percentage hatched and gave rise to fundatrices. At Pretoria, ten generations of fundatrigeniae were observed on peach between September and November. Few migrants were found in September or early October, and the main spring migration from

peach occurred in October–November. No observations on spring development were made at Rietriver and a few only at Rietvlei. Migration was studied at all three places by means of Moericke traps [*cf.* **45** 315]. It decreased to a negligible amount at Rietvlei and Rietriver during June–October, but a remarkable peak was observed at Pretoria in August, in addition to the peaks in May and November that coincided with migration to and from peach. This peak, together with the moderate amount of migration that occurred in June, July, September and October, indicates considerable anholocyclic overwintering at Pretoria. Anholocyclic overwintering was observed on cabbage and cauliflower at all three places, and the aphid was occasionally found in winter on *Sonchus oleraceus*, *Galinsoga parviflora* and *Althaea rosea*. The status of holocyclic populations of *M. persicae* is discussed [*cf.* **49** 280], and data obtained in limited breeding experiments with strains derived from populations overwintering holocyclically and anholocyclically are given.

Lavabre (E.). **Recherches sur une méthode économique de contrôle des Mirides du cacaoyer.**—*Café, Cacao, Thé* **4** no. 1 pp. 16–25, 12 figs. Paris, 1960.

Surveys of the seasonal fluctuations of *Sahlbergella singularis* Hagl., the most important of the Mirids attacking cacao in the Cameroon Republic, were made in seven localities in the central area in 1957–59. Counts of the insects in untreated sample plantings of different ecological types showed that heavily shaded areas were less favourable to the Mirid than open ones and that populations were lowest between December and March–April and highest between July and October. It is suggested that insecticides should be applied when the numbers are beginning to increase and again 4–7 weeks later, before maximum reproduction begins. The appropriate times should be determined for each area, and will probably be towards the end of June and in August. *S. singularis* is susceptible to all modern insecticides but heptachlor, and to sprays, dusts and fogs; BHC is the most economical, but as it has some phytotoxic effect and may destroy pollinating insects, parasites and predators, it should be used with caution. A spray of 2 quarts 16 per cent. γ BHC (lindane) per 100 gal. is recommended; it should be applied over areas as large as possible, to prevent rapid reinfestation, and not more than twice a year, except where infestations are very injurious. Proper cultural operations, including the removal of suckers in October–November, should be carried out, and trees providing shade should not be destroyed.

Staniland (L. N.). **Fluorescent tracer techniques for the study of spray and dust deposits.**—*J. agric. Engng Res.* **4** no. 2 pp. 110–125, 11 figs., 5 refs. Silsoe, Beds., 1959. (With summaries in French & German.) **Simple daylight detectors for the examination of fluorescent traced sprays.**—*Chem. & Ind.* 1961 pp. 502–503, 1 fig., 4 refs. London, 1961.

The following is substantially the author's summary of the first paper. The technique of using fluorescent tracers for the study of spray and dust deposits on plants or insects and in soil is described. Some of the tracers are suitable for use as suspensions, others can be mixed with sprays containing chemicals in solution, where information on the exact areas wetted by a fluid is required, or can be incorporated in emulsion sprays where knowledge regarding the situation of deposits of the solvent and the contained insecticide is required. Crystals of certain insecticides are shown to have the power of adsorbing fluorescent dyes on their surfaces, thus becoming fluorescent. The

use of these tracers in the field is described [*cf. R.A.E.*, A **49** 247], and the scope for their more extended application is discussed. Information on the visual examination and photography of fluorescent deposits is included.

In the second paper, a description is given of a simple apparatus for examining labelled deposits in the field, in which Wood's glass (or ' black glass ') is used to exclude visible light, so that only ultraviolet light is allowed to pass.

Janmoulle (E.). **Distinction entre** *Evetria buoliana* **Schiff. et** *E. pinicolana* **Dbld. (Tortricidae).**—*Lambillionea* **58** no. 3–4 pp. 29–30, 2 figs. Brussels, 1958.

Since investigations on the biological control of *Rhyacionia* (*Evetria*) *buoliana* (Schiff.) on Scots pine [*Pinus sylvestris*] in Belgium may be prejudiced by confusion of this moth with the very similar *R.* (*E.*) *pinicolana* (Dbd.), which is present on the same tree there, characters are given by which the adults of these Tortricids can be differentiated.

Urošević (B.), Kalandra (A.) & Šrot (M). **Příspěvek k poznání příčin kalamitního usýchání borovic v českých zemích.** [Contribution to knowledge of the causes of mass desiccation of conifers in western Czechoslovakia.]—*Sborn. čsl. Akad. zeměd. Věd.* Lesnictví **7** (**34**) pt. 4 pp. 369–388, 4 pls., 13 figs., 24 refs. Prague, 1961. (With summaries in Russian & German.)

In investigations in the autumn of 1959 and the spring of 1960 on the causes of a mass desiccation of pine (*Pinus sylvestris* and *P. nigra*) in the forests of western Czechoslovakia, the authors isolated numerous fungi, including one pathogenic species, from affected branches and bark, and found that the trees were attacked by 16 species of insects (mostly Coleoptera), none of which was considered a primary factor in mortality. The commonest was *Myelophilus piniperda* (L.).

Jones (G. D. G.) & Green (E. H.). **A comparison of the toxicities of pyrethrins and synergised pyrethrins to** *Calandra oryzae* **L., and** *Calandra granaria* **L.**—*Pyrethrum Post* **5** no. 2 pp. 3–7, 6 graphs, 12 refs. London, 1959.

The following is virtually the authors' summary. In the investigations described, *Sitophilus* (*Calandra*) *granarius* (L.) was shown to be about twice the weight of *S.* (*C.*) *oryzae* (L.) when both were reared in wheat, and there was a 25–40 per cent. increase in mean weight when the weevils were reared in maize. *S. oryzae* reared on maize almost equalled *S. granarius* fed on wheat. These weight differences were related to the susceptibility of the species to pyrethrins. It appeared that there was a significant positive correlation between body weight and resistance to pyrethrins, which was independent of species. A parallel result was obtained when γ BHC was used. The responses of the species to piperonyl butoxide as a synergist for pyrethrum differed markedly; when exposed to a dust with a pyrethrins: synergist ratio of 1:8, *S. granarius* evinced a response exactly three times as great as that shown by *S. oryzae*.

PAPERS NOTICED BY TITLE ONLY.

TRACY (R. L.), WOODCOCK (J. G.) & CHODROFF (S.). **Toxicological aspects of 2,2-dichlorovinyl dimethyl phosphate (DDVP)** [dichlorvos] **in cows, horses, and white rats.**—*J. econ. Ent.* **53** no. 4 pp. 593–601, 2 graphs, 37 refs. Menasha, Wis., 1960. [See *R.A.E.*, B **49** 150.]

MCFARLANE (J. E.), NEILSON (B.) & GHOURI (A. S. K.). **Artificial diets for the house cricket,** *Acheta domesticus* **(L.).**—*Canad. J. Zool.* **37** (1959) no. 6 pp. 913–916, 8 refs. Ottawa [1960].

HO (F. K.). **Discrimination between the pupae of** *Tribolium confusum* **Duv. and** *T. castaneum* **(Hbst.) (Coleoptera: Tenebrionidae).**—*Ann. ent. Soc. Amer.* **53** no. 2 pp. 280–281, 2 figs., 3 refs. College Park, Md., 1960.

HUBERT (F. P.). **A review of** [fumigation and other] **treatments of** *Citrus* **fruits for control of Mediterranean fruit fly** [*Ceratitis capitata* (Wied.)]. —*FAO Plant Prot. Bull.* **9** (1960) no. 3 pp. 33–36, 1 ref. Rome [1961].

BÉNASSY (C.). **Étude bio-écologique de** *Pseudaulacaspis pentagona* **Targ. et de son parasite spécifique** *Prospaltella berlesei* **Howard, en France.**—*Ann. Épiphyt.* **9** (1958) no. 4 pp. 425–496, 34 figs., 2½ pp. refs. Paris. 1959. [For shorter account see *R.A.E.*, A **48** 82.]

TOMINIĆ (A.). **Rezultati višegodišnjih ekoloških ispitivanja maslinovog moljca.** [Results of several years' ecological investigations on *Prays oleellus* F. (on olive in Yugoslavia)].—*Plant Prot.* no. 46 pp. 27–49. 5 figs., 14 refs. Belgrade, 1958. (With a summary in English.)

MATSUZAWA (H.). **Ecological studies on the Braconid wasp,** *Apanteles glomeratus* [parasitising *Pieris rapae* (L.) in Japan]. [*In Japanese.*]—*Mem. Fac. Agric. Kagawa Univ.* no. 3, 125 pp., 5 pls., 39 figs., 230 refs. Mikityô, 1958. (With a summary in English.)

IWATA (T.). **Ecology of the larval growth of summer generations of the rice stem maggot,** *Chlorops oryzae* **Matsumura, in Takada Province. I. Summary of the larval survival and injury.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **2** no. 4 pp. 258–263, 4 graphs, 8 refs. Tokyo, 1958. **II. On the growth of the second generation larvae on various stages of host rice plants and difference of larval growth in the first and the second generation.** [*In Japanese.*]—*Op. cit.* **3** no. 1 pp. 1–6, 1 graph, 5 refs. 1959. (With summaries in English.)

ISHII (S.) & HIRANO (C.). **Effect of fertilizers on the growth of larvae of the rice stem borer,** *Chilo suppressalis* **Walker. II. Growth of the larvae on the rice plants cultured in nutrient solutions of different nitrogen level** [confirming previous results (*R.A.E.*, A **49** 163)]. [*In Japanese.*] —*Jap. J. appl. Ent. Zool.* **3** no. 1 pp. 16–22, 1 graph, 29 refs. Tokyo, 1959. (With a summary in English.)

TSUJI (H.). **Studies on the diapause of the Indian-meal moth,** *Plodia interpunctella* **Hübner. II. The** [positive] **effect of** [high] **population density on the induction of diapause.** [*Cf. R.A.E.*, A **47** 451.] [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **3** no. 1 pp. 34–40, 4 graphs, 3 refs. Tokyo, 1959. (With a summary in English.)

KISIMOTO (R.). **Studies on the diapause in the planthoppers and leafhoppers (Homoptera). II. Arrest of development in the fourth and fifth larval stage induced by short photoperiod in the green rice leafhopper,** *Nephotettix bipunctatus cincticeps* **Uhler** [*N. apicalis* var. *cincticeps*]. [*Cf. R.A.E.*, A **48** 409.]—*Jap. J. appl. Ent. Zool.* **3** no. 1 pp. 49–55, 6 graphs, 10 refs. Tokyo, 1959. (With a summary in Japanese.)

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